

1869

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REVIEW OF THE PROGRESS OF SANITATION IN
INDIA.

THE following sketch is intended to represent a general view of the progress of sanitation in India during the decennial period ending with 1869. Before the commencement of the ten years noted, or previous to the termination of the mutinies, sanitation, as now practised in this country, can scarcely be said to have been initiated. But following on the transfer of British India to the Crown, and the consequent more direct attention of the British public to its Indian possessions, the sanitary movement then in progress in England was by various earnest reformers urgently demanded for India. For some years previously, thanks to Wakley of the *Lancet*, Lee of the *Medical Times*, to Rose Cormack of the *British Association Medical Journal*, to the *Sanitary Review*, to Ranald Martin, to Simon, Sutherland, Milroy and others, the necessity of sanitation, in the broadest or "State" sense of the term, had been pressed upon the public and upon those set in authority. The annual reports of the recently formed Medical Department of the Privy Council, with Simon at its head, had made a large proportion of the reading and discerning public understand, that the extermination of scurvy, dysentery and intermittent fever in London, in Edinburgh, and in Britain generally, had been contemporaneous with drainage, cultivation, the supply of better food, and the adoption of more complete sanitation in other matters, such as cleanliness and attention to water supply and conservancy. *Typhoid*, or as now often called *intestinal* or *pythogenic* fever, for instance, had become associated even in the public mind with accumulations of dirt and filth. Similarly, *typhus* fever was recognized as a result of overcrowding. Cholera, under the ever memorable investigations of Snow, was first mentioned as disseminated through the medium of water. Various trades, proved to be destructive to human life, had been made the subject of legislation, and the followers of them protected, as much as possible, from the injurious consequences of their employment. And passing from civil to military matters, we find that during the time which elapsed between the middle of the Crimean campaign and the transfer of India to the Crown, the health-rate of the soldier at home had been raised from that of the baker and compositor to the standard

of the middle-class civilian. During the Crimean war, the British nation saw the decimation of an army caused by defective sanitation and the want of concert of departments; while its efficiency was so far restored during the same campaign that it contrasted favourably with the legions employed at home, owing to the enforcement of sanitary regulations, and the reinforcement of, and the more systematic control of, the medical department. In the quickly following China war again, similar measures enabled us to show what was then designated as "the almost unparalleled spectacle of an army moving rapidly in an enemy's country, and that country the sea-coast of a semitropical district, in the highest condition of health and efficiency," where the mortality was just one-tenth less than the death ratio of the army in the Crimea during the first seven months of that disastrous campaign.

Of course there were not wanting popular writers to compare, not only the first period of the Crimean war with the second and with the China campaign, but also with former periods of English warfare, and with the condition of our troops during the service consequent on the sepoy mutiny. It was recalled to recollection that the sufferings of British troops at Walcheren might have been avoided, had Sir Lucas Pepys, then President of the Army Medical Board, been consulted before the troops were sent to that pestilential locality. It was recollected that a book had long before been published by Sir John Pringle, in which particulars were given of the sickness and death of the soldiers stationed sixty years before in Walcheren. And yet years later, from a similar cause, Sir Eyre Coote, commanding for Lord Chatham (who sailed away to England leaving some 8,000 men *hors de combat*), gave notice that the sick must be abandoned in case of any attack from the enemy! The treatment Wellington experienced during the Peninsula campaign, when (not to the credit of the ministry of those days, by whom ordinary supplies were refused) a number equal to the whole force passed through the hospital twice every year, was also remembered. The disastrous Burmese campaign of 1826 was reproduced in all its haggard particulars; while, lastly, the second Burmese war, approaching in deadliness to the first, was also brought forward as evidence of the little attention previously given to sanitary matters.

The temper of the nation, therefore, excited by the accounts from India during the mutinies, and prepared both by the persistent representations of sanitary reformers, and the results

of sanitation at home, was ripe for insisting on the extension of State medicine and hygiene to this country. Foremost in the good cause was Ranald Martin, who, from his position of vantage as Physician to the India House, and with experience acquired in India, reiterated the truths contained in the first portion of his work "On the Influence of Tropical Climates," and on several occasions addressed the Court of Directors, or the Secretary of State, on various matters connected with sanitary reform in India. It was pointed out that, although sanitary arrangements, begun at home, had been extended with success, especially amongst the troops, to the North American stations, to the Mediterranean, to the West Indies, &c., India, with its 80,000 European soldiers, remained to be dealt with. The statistics of Tulloch, of Sykes, of Hugh Macpherson, and the report of the Army Sanitary Commissioners, were quoted and freely commented upon. Nor was it long before the late Lord Herbert, then Mr. Sydney Herbert, with Crimean recollections and experience fresh in memory, turned his attention to Indian subjects, and especially to Indian sanitation. Than this lamented nobleman, no one was more anxious to impress on Parliament the great fact that prevention is better than cure. And in this the powerful aid of Miss Nightingale was unobtrusively but effectually rendered to the Indian cause. The progress of sanitation in India, thus commenced, will be shown in the following pages. The results are, perhaps, not so apparent for good as could be desired. But sanitation can scarcely be regarded as commencing with the decade. As will become apparent, the initiation of sanitary measures with respect to many important matters dates from a much more recent period than 1859.

One of the first important sanitary steps of the decade was the appointment of Dr. Hathaway to inspect and report on the conservancy arrangements in the principal military stations of the Panjab. Dr. Hathaway's report is one of the best papers ever published on the subject, and recommended the *dry* system of conservancy, presently to be altered, if not improved, into the *dry earth* system. But Dr. Hathaway's paper moreover treats of sanitary matters other than conservancy, entering into the questions of rations, water, intemperance, syphilis, and various subjects affecting the health of the troops. In a special report on Dr. Hathaway's proposals by

a Commission * appointed for that purpose at Delhi, his system of conservancy was unanimously approved, and would probably have been adopted throughout India, as it had been some time before carried out in the Panjab jails, had not Moule's system been shortly afterwards proposed.

At the close of 1863 a Sanitary Commissioner, or rather Health Officer, was appointed for Calcutta, and in 1864 Bombay was similarly supplied.

The year 1863 was further marked by the appearance of the "Report of the Royal Sanitary Commissioners appointed to enquire into the sanitary state of the Army in India." This Commission, first appointed in 1858 under the presidency of the late Lord Herbert,† pursued its investigation by the examination of a large number of Indian officials of all classes, by inspecting the old records of mortality from the commencement of the century, and by obtaining an accurate account of the various military stations of British India, with all sanitary defects as then existing. The two large volumes, the result of this investigation, are monuments of labour and research, and may well be designated the *Magna Charta* of sanitary reform in India; from which sprung most of the measures of which we are now, or our successors will be, reaping the benefit. And it is only just to add, that to Sir Ranald Martin, K.C.B., belongs the credit of persistent efforts to obtain such a Commission, and of many of the sanitary measures proposed by the Commission.

The small amount of attention formerly vouchsafed to Indian matters, was well exemplified in what followed the publication of this report. The announcement that since the commencement up to the termination of the first half of the present century, the rate of mortality among Europeans in India had averaged 69 per 1,000 annually, was received with astonishment and indignation. Sir Charles Wood, then Secretary of State for India, stated in the House of Commons on July 14th, 1863, that "the Report of the Commission had brought to light a rate of mortality which, before its publication, no one

* *President*—Colonel Paterson.

Members—Surgeon Fowler.

" C. Campbell, Esq., C.E.

† The Report of the Commission is signed by Stanley, *President*.

Members:

Proby T. Cautly.	J. B. Gibson.
J. R. Martin.	E. H. Greathead.
John Sutherland.	W. Farr.

“believed to exist.” The *Times* remarked, “people might be prepared to hear” that the mortality “was double that which prevailed in English barracks before anything was done to improve them. Even this exaggerated estimate, we regret to say, would fall very far short of the truth.” And other journals, even some medical journals, followed suit, commenting on the discovery of the great mortality of Europeans in India. In the *Lancet* only was there any reference made to the writings of those medical officers and others, who had pointed out the death-rate years before. At the very time the House of Commons listened to the statement that the Sanitary Commission had discovered a rate of mortality which no one believed to exist, such works as Col. Sykes’s *Statistical Tables*, Macpherson’s *Statistics*, Ewart’s *Vital Statistics of the Indian Armies*, Chevers *On the Means of Preserving the Health of the European Soldier in India*, and Moore’s *Health in the Tropics*, had long passed through the press, all reiterating the oft-told tale of men *disappearing* at the rate of 69 per 1,000.

The principal recommendations of the Royal Sanitary Commission, appointed to enquire into the condition of the Anglo-Indian army, were as follows:—That recruits forwarded to India should be 21 years of age: That the issue of spirits on boardship should be discontinued except under medical advice: That the sale of spirits in the canteen should be discontinued: That the rations should be modified with regard to season: That increased facilities for amusement and instruction should be afforded to soldiers in India: That the period of service in India should be limited to ten years: That invalids should be passed on home without delay: That more attention be paid to drainage and water-supply: That barracks should be built on basements: That the size of barracks should not exceed the proportions required for a half or quarter company: That the cubic space allowed should not be less than from 1,000 to 1,500 feet: That cook-houses, ablution-rooms and latrines, should be constructed on improved principles: That the cubic space in hospitals should not be less than 1,500 feet, and the superficial space 130 feet per man: That the strategical positions be fixed, with a view to reducing the number of unhealthy positions now occupied by European troops: That engineer officers be required to undergo a course of sanitary instruction at Chatham: That a Sanitary Commission be formed at each Presidency, so constituted as to represent the various elements, civil, military, engi-

neering, and medical : That a War Office Sanitary Commission at home be formed in association with the Indian Commissions : That a code of sanitary regulations be authoritatively published : That a system of registration of births and deaths be enforced : That the sanitary duties enjoined on medical officers, by the Medical Army Code, published in October 1859, be made applicable to medical officers in India.

A very brief period elapsed before the above recommendations bore fruit. G. G. O. No. 87 of 1864 stated that, in accordance with the instructions of the Right Hon'ble the Secretary of State, a Sanitary Commission was appointed to consider and afford advice and assistance in all matters relating to the health and welfare of the army, and to supervise the gradual introduction of sanitary improvements in British stations, as well as in towns in proximity to military stations. Mr. Strachey was appointed President, and Dr. Gordon, C.B., Major Cooper, and Captain Williams, R.E., Members, with Dr. Walker as Secretary. Very shortly after, similar Commissions were formed in the Madras and Bombay Presidencies. In the communication from the Secretary of State directing the procedure, the imperative duty of using the best endeavours to bring to bear on the condition of the European soldier in India those discoveries in sanitary science attended with most benefit at home, was impressed on the Indian Government. Hence it was directed that the conclusions of the Royal Sanitary Commissioners should be carried out, not only in the appointment of Indian Commissioners, but also as regarded sites of stations and barraeks, diet, recreations, prevention of venereal disease, registration of deaths, &c. &c. And in the Government letter, No. 1044 of 1864, to Sanitary Commissions, it was stated that "Government does not intend that the Commission should be merely a deliberative body, having merely a collective responsibility. It will look to the President as the officer responsible for obtaining and affording the best information and advice on all matters of sanitary import, and for exercising a proper supervision over the whole of the sanitary administration." Practically, although not in name, a department of Public Health had been established.

With the meritorious, but somewhat mistaken view, of correcting any errors into which Indian sanitary authorities might fall, it was ordered by the Secretary of State, that plans, either for the construction or alteration of barraeks or hospitals, as well as plans for drainage and sanitary improvement of special localities, should, after approval by the Indian Sanitary Commission, be referred

for final sanction in England! A code of sanitary regulations was also to be framed, and submitted for home revision! For, it was remarked, "many of the officers, serving on the "Indian Sanitary Commissions, will necessarily be unacquainted "with the more recent improvements in sanitary science." But without denying that such may be the case, it may be confidently affirmed, that neither now, nor in 1864, was there any want of officers in India, quite as capable as any at home to carry out Indian sanitary reforms. Otherwise the Service had not possessed a Chevers, a Leith, a Ewart, a Macpherson, a Cornish, or a Murray.

The Sanitary Commissions, as above constituted, proving cumbersome and not being able to move about so freely as necessary, an order was published in 1866 modifying their constitution. The duties have from that period been carried on by one Sanitary Commissioner and a Secretary. But it was ordered that when deemed advisable for the consideration of any particular subject, officers best acquainted with the matter, whether civil, military, or medical, were to be associated with the Commissioner. It was also intimated, that the measures deemed necessary for exercising a more complete supervision over civil sanitation, and for ensuring continued attention to public health, would be further considered. Accordingly, during the following year, Sanitary Commissioners were also appointed for the North-West, the Panjab, Bengal Proper, Oudh, and British Burmah.

In determining the nature of the duties to be discharged by the new Sanitary Commissioners, Government drew attention to the fact that the appointments were created "solely "for the purpose of improving the sanitary condition of the "people," and that considering the magnitude of the task, the officers chosen should not be called upon to undertake any work, which is not intimately associated with the special object for which they are appointed. It was formerly suggested that Sanitary Commissioners should also inspect jails and dispensaries, and superintend vaccination, but on mature consideration the Governor-General in Council was of opinion that "this is *not* advisable." Neither, as was proposed, is it considered advisable that the Sanitary Commissioner should keep a watch over food supplies, as regards deficiencies and scarcity from failure of agricultural operations—such work more properly belonging to district officers. The Government of India record "the absolute "necessity of reducing to reasonable limits the points to which "a solitary Sanitary Commissioner, appointed over a country

"as large as France, should address himself in the first instance." Hence the Civil Sanitary Commissioner should be relieved from all duties connected with cantonments, where local boards of health exist. Briefly stated, the duties of local Sanitary Commissioners are as follows :—

1. To ascertain the existing sanitary condition of the country under their charge, and suggest measures for its improvement.
2. To advise Local Governments and Administrations in matters concerning the public health.
3. To collect information as to the unusual prevalence of diseases in any particular locality, and to suggest measures for their removal ; and to supervise measures for the prevention of venereal disease in the neighbourhood of military cantonments.
4. In case of any unusual visitation, to proceed to the spot, endeavour to trace its source, and aid in carrying out remedial measures.
5. To examine all localities in which cholera, fevers, and similar diseases are endemic, and propose means for removing them.
6. To assist in organizing, as well as circumstances will allow, a proper system of registration of births and deaths, unless this duty be entrusted by the Local Government to some other officer.
7. To prepare a medical topography of their respective provinces or presidencies.
8. To submit to Local Governments and Administrations a carefully digested annual report of their proceedings, and, in case of the outbreak of epidemic diseases, to forward early reports of all their proceedings.
9. To furnish the Imperial Sanitary Commissioner with copies of their reports, and generally to keep him informed on all matters of sanitary importance.

These appointments are yet of too recent date to show very great beneficial results. But several reports, already submitted by the Sanitary Commissioners, are an earnest of what may ultimately be effected ; such, for instance, as Dr. B. Smith's account of the epidemic fever in the Hooghly District ; Dr. Cutcliff's report on fever in the Meerut Division ; and the mortality tables of the North-West Provinces.

Regarding the advisability of having sanitary officers in India, there can be no manner of doubt. But it is questionable if the separation of the sanitary officer from the administrative ranks

of the medical department was a wise and sound step. There are those who hold the opinion, that it would have been far more advantageous to the public good, had the sanitary office been combined with that of Deputy Inspector-General of Hospitals of the Indian Service, the number of the latter grade being of course increased, and their circles of superintendence diminished. At the present time, we have the Sanitary Commissioner with the Government of India, the local Sanitary Commissioners, and the medical authorities, all working independently, all calling for reports, all pursuing similar investigations, all travelling over the same ground,—a waste of strength which could not have been anticipated. It is true, a combination of the administrative, medical and sanitary officers, would have entailed extra expenditure under the former head, but at the same time, the cost of the latter would not have been added to the estimates. It is also true that such a combination would have limited the choice of sanitary officers to the Medical Service. But this, we submit, ought to be the case. Medicine and sanitation cannot be separated. The attempt to sanitize without medical acquirements must end in failure. Sanitation may of course be separated from the practice of physic—perhaps should be so; but it cannot be isolated from an acquaintance with the etiology and causation of disease, from physiology, chemistry, and medical climatology. And such knowledge is not obtained without special and prolonged education.

The report of the Royal Sanitary Commissioners shows that the average mortality of European soldiers in India, during the first-half of the present century, was 69 per 1,000 of strength. But the same report also demonstrates that there was, during the period named, a gradual diminution in the death-ratio. While during the first quarter of the century the mortality was considerably above 96 per 1,000, during the second quarter it fell much below that figure. In the Bengal Army the death-ratio during the 12 years ending 1853-54 was 20 in the 1,000 lower than that prevailing in the 12 years ending 1821. In Madras, the deaths diminished one-half from the commencement of 1800 to the end of 1852. In Bombay, the death-rate for the decennial period ending 1856 did not exceed 10 per 1,000 per annum. For the 15 years, ending 1856, the mortality for the whole of India was not more than 51 per 1,000. And this, it must be recollected, was before what may be called the sanitary era in India. For

the same period the rate of invaliding averaged 29 per 1,000 ; the total loss to the service, therefore, from sickness being some 80 per 1,000. For the six years ending 1867, the mortality among soldiers for the whole of India was 26·55, and the invaliding 48·70, the total loss to the service, therefore, being 75·25. The difference between these last figures, namely, 75·25, and the total for former years, namely, 80, or about 5 per 1,000, must represent the total gain of the last few years. Unquestionably, the mortality has been considerably reduced, but, in exact ratio to this diminution, there has been an increase in the number of men invalided. Had not the invaliding list risen from 29 to 48 per 1,000, it is more than probable the death-rate would have remained at the old figures. And this in spite of all our sanitary endeavours. The reflection that such is the fact may be humiliating to sanitarians, but it is none the less a fact, and cannot be ignored. It would appear that whatever endeavours we make, a certain penalty of sickness and death, or of invaliding and death, must be paid by the British Army of occupation in India. And that this is so, is signally proved by the fact that the death-rate of the women and children, who are seldom if ever invalided, has not at all lessened. As it was in years gone by, so it is now. European women, in their capacity of soldiers' wives, still die at the rate of 46 per 1,000 ; while children inhabiting barracks maintain the mortality of some 80 per 1,000. Now, it is unquestionable that, had our sanitation lessened the death-ratio of the men, it must have produced similar effects on the women and children living under the improved hygienic conditions. But such has *not* been the case. The mortality of these classes remains much the same—for they are not invalided.

The gain of some 5 per cent. in the mortality rate of the men, may be, in a great measure, attributed to the Short Enlistment Act. Soldiers do not now remain so long in the country. Enlisting for 10 years, some portion of that period is always served before they place foot in India. And at the termination of the period, very few now volunteer to remain in the country. Length of residence always tells upon health and vital statistics, and somewhat of the diminished death-ratio must be attributed to this cause alone. Again, we have the prevalence of better habits of life, and a change of medical practice from the depleting system of former times ; both causes tending to the prolongation of European existence in India. The benefit, therefore, directly attributable to sanitary reforms is small indeed !

Such considerations naturally lead to the questions,—Is sanitation therefore a myth? Or are we sanitating in the right direction? Certainly sanitation is no myth. But the best of hygienic measures will not change the climate. So long as the European is exposed to the tropical sun, the monsoon deluge with its malarious results, and the tendency to congestion of internal organs consequent on the cold weather, sickness must result; and this, notwithstanding the greatest care, and the most magnificent buildings as residences. The great majority of men invalided are sent home for malarious atrophy following fever, and the frequent degeneration into such condition is inseparable from residence on the plains of India. The remedy is the removal of the men into a climate more resembling that of their native land; or, in other words, by the more systematic use of hill stations. It is only by such sanitary measures that we can hope to diminish the death-ratio, without increasing the invaliding list.

It is a curious fact that, until the period of the Crimean war, very little attention had been paid to the construction of barracks or hospitals, either civil or military. We believe we are correct in stating that ten years back no book existed in which the subject had been treated. Hospitals were built without any recognized principles of guidance, and any long barn-like building, capable of affording shelter to a number of men, was esteemed fit for a barrack. Now, matters in this respect have altogether altered, and the tendency is towards over-elaboration of detail, and massiveness of structure. As will be mentioned in the proper place, there are reasons for the opinion that the palatial barracks now being built, are mistakes. And with regard to hospitals, we cannot but recollect the remark of an old army surgeon of the last century, Robert Jackson, that he would rather treat his patients behind hedgerows, than in the finest building where fresh air was not constantly obtainable.

Colonel Crommelin having been specially appointed to consider and report on the numerous important questions involved in the construction of barracks and hospitals for European troops, submitted a report in 1866. This having been referred to local governments and sanitary authorities, the Supreme Government passed the following conclusions as the basis of a standard plan. But the impossibility of determining on one, or even several standard plans, to meet the varied circumstances of locality and climate found in India, was acknowledged. Therefore deviation

from the general plans laid down is permitted, when necessary, for peculiar local reasons.

1. Barracks should be of moderate size, as admitting of better sub-division of the men, and more efficient ventilation than either larger or smaller buildings. For infantry, half-company barracks should be built; for batteries, one or two barracks, as site and other circumstances render most desirable.

2. Each barrack should contain rooms capable of holding from sixteen to twenty-four men.

3. Barracks, except at hill stations, should be upper-storied, allowing 90 superficial and 1,800 cubic feet per man.

4. Married quarters should consist of two apartments, 16 × 14 feet, and grouped in blocks; as a general rule, being single storied.

5. For hospitals, the component parts, as wards for sick and convalescents and the different offices, are laid down with great minuteness, the space required being as much as 120 superficial and 2,400 cubic feet per man. For native troops the hospital accommodation required is much less elaborate.

It is understood that barracks and hospitals, according to Colonel Crommelin's plan, as modified by Government, are to be erected at every station. Those who are aware of the old structures will at once appreciate the immense changes thus introduced, and admit the excessive attention which has been bestowed on the subject of late.

Various matters, affecting the internal economy of military life, have been considered during the decade under review. In 1861 a report was called for from medical officers in the Bombay Presidency, regarding the relative merits of coir and straw mattresses. In 1862, wooden gratings for the men to stand on when washing, were ordered for all barracks, &c. A committee was also appointed to enquire into the system of rationing, and a series of orders, not unrequired, were published regarding barrack cookery. In 1863, new rules for the supplies of *tatties* were issued. Attention was also directed to cork mattresses, particularly for marching, which, Sir Ranald Martin states, are less absorbent, and do not engender putrefaction like cotton, wool, flax, &c. Being light, a slow conductor of heat, and when cut into small flakes, and placed in a cover, free from lumps, cork would appear well adapted for the purpose. Horse-hair also is a good stuffing, but scarcely procurable in sufficient quantity. In 1865, G. O. C. No. 278, 16th March 1865, calls

attention to the better provision of filters in barracks. And No. 35 of 1865 revises canteen rules, fixing the daily amount of liquor issued at one dram of rum, and one quart of malt liquor. A committee was also appointed at Roorkee to take into consideration the best method for cooling and ventilating barracks and other public buildings. Reports as to the best system of ventilation were also called for from various officers. A patent self-acting punkah, devised by the Rev. Mr. Calderwood, was tried; in 1866, another by Mr. Saintyves, and a thermantidote machine by Mr. Livingstone. But it is believed that a cheap self-acting punkah, not liable to get out of order, is still a desideratum. In 1867, Mr. Turner proposed a new kind of exhausting fan for the ventilation of barracks. In 1869, Government issued an order directing that, when considered necessary by the medical officer, *tatties* should be used at night in barracks, hospitals, and cells, whenever at 9 p.m. the thermometer indicates a temperature of, or in excess of, 95°F., provided the wind is not from the east, when *tatties* can have no good effect, as then the air is already too moist to permit evaporation. And the systematic enforcement of this boon will doubtless do much to prevent those epidemic attacks of heat asphyxia, from which from time to time so much mortality has occurred. In 1861, a great step towards the comfort of clerks and other public employes was taken, in allowing *khus-khus tatties* for the Supreme Court and other public offices.

Whether considered with reference to the health, or comfort of European officials, particularly military officers in India, there are few subjects of greater importance than the dwellings they inhabit. In this country, the opportunities of out-door life for the European, are, during the hot season and monsoon rains, reduced to a minimum. So much time is necessarily spent in-doors, that a structure, capable of affording protection from the weather, is most important. But unfortunately, the "bungalows" in which the great majority of European military officers live, are most inferior buildings. Small, covered with a leaky and too often rotting thatch, supported by walls of mud which become inordinately damp during the rainy season; frequently level as regards flooring with the surface of the ground (the floor itself sometimes nothing more than the ground), an Indian subaltern's "bungalow" is generally inferior to a moderately provided stable at home. Neither are many of the houses of the higher grades of officers very much superior.

And to this state of things many causes combine ; actual inability to devote any sufficient sum of money to the purpose, frequent change consequent on military life, the fact of houses being often the property of natives, who have neither the inclination nor knowledge how to render them better adapted to the wants of Europeans,—all combine to render the bungalows in British cantonments the melancholy depressing sights they now appear.

The desirability of remedying the present state of matters, by Government providing quarters for its officers, has often been mooted. And with reference to this subject, the army owes a debt of gratitude to Sir William Mansfield, who has strenuously endeavoured to provide a remedy for the evil. When Commander-in-Chief of the Bombay Army, His Excellency submitted certain proposals to the Bombay Government, regarding the tenure of house and other property in military cantonments, which unfortunately did not meet with the approval of Sir Bartle Frere. It was suggested that, with the exception of lines or isolated houses required for Staff or Regimental officers' barracks, parade grounds, jails, &c., all portions of military cantonments, should be handed over to the civil authorities, and all unoccupied land in the neighbourhood sold ; the office of Cantonment Magistrate being abolished. With money thus realized, or saved, His Excellency proposed eventually to purchase all officers' bungalows, so that in time the State would become the landlord of the whole of the military. The position would in fact be that which obtains at home, bungalows being substituted for barracks ; while, as at home, for offences not purely military, justice would be administered by the civil authorities in place of the Cantonment Magistrate. Shortly after His Excellency's transfer to Bengal, a further memorandum appeared " on the question of providing quarters by the State for officers." It is here mentioned that His Excellency has, at different times, given a great deal of thought to the subject of lodging officers in India, " and is moreover convinced of the necessity of Government undertaking the task." Attached to the memorandum were sketch plans of accommodation thought desirable, which, at a moderate rental, would return 5 per cent. interest. Experimental measures were sanctioned at Allahabad, Morar and Nowgong, but the suggestions, admirable as they were, have not been generally acted upon. Neither would it appear that any intention existed of so doing. For in 1867 Government in the Military Department sanctioned the grant of a loan, according to rank and

pay, to all officers desirous of building better residences. The loan was to be paid back without interest, by instalments. But the order granting the privilege has since been rescinded. And in reality the abrogation is not any vital loss to the interests of military officers. As was observed on the subject,—“A loan without interest for such a purpose may sound “liberal enough, but when it is remembered how much money “must be frittered away in a first attempt to build, or in contract- “ing for the building of a house, the money is dearly enough “paid for in the end, while from the Government point of view “the houses thus built are not such as are of advantage to a “cantonment.”

The cantonment regulations in India have been devised with the endeavour to please two parties, *viz.*, both the landlords and the tenants of the bungalows. But, as usual with such attempts, the result has been a failure. The landlord, it is true, is protected against loss by courts of requests, and there is probably no money more surely and regularly paid than house-rent in India. On the other hand, the civilian owner of a bungalow in military cantonments is not permitted to do exactly what he likes with his own. The rent is fixed by a committee, generally it must be confessed at a fair remunerative rate, but the owner cannot raise it if he finds one willing to give a higher price. Neither can he live in his house himself, if it be required by an officer belonging to the brigade.

Yet notwithstanding all these regulations, it annually becomes more difficult for officers to procure even fair house accommodation, and unless some other inducement, than now exists, be given to cause capitalists to lay out money upon such property, no improvement will take place. And such inducement cannot proceed from a rise in the rental, the funds of the large majority of military men not permitting it. The alternative is, that eventually Government must become the landlord. And the sooner this is determined, the quicker will officers be lodged in healthy and suitable residences, which at present the great majority are not.

In 1861 regulations for a much required institution in the shape of an Officers' Hospital in Calcutta were published. An officers' hospital was not by any means a new idea, for in 1787, Mr. Dick, Assistant Surgeon in the Company's Service, proposed a two-storied house as a hospital, the upper flats to be occupied by sick or insane officers, the lower by sick soldiers, and the Governor-General in Council approved of the

proposition, and directed the Board of Revenue to select a spot of waste ground on which a house might be erected. In 1863, the old *Bentinck*, formerly a P. & O. vessel, was converted into a floating invalid depôt on the Hooghly. Both these establishments were, however, afterwards abolished, and there is no such institution in any of the three Presidencies.

The desirability of an officers' hospital cannot be questioned. Numbers of sick officers monthly arrive in the presidency towns, recommended for furlough to Europe by mofussil medical men, who, in a weakened, debilitated, or even perfectly disabled condition, are entirely dependent on either expensive hotels, which they can ill afford, or on the charity of friends, which delicacy forbids many to accept, even if offered.

For many years previous to the commencement of the decade under review, venereal disease in the British Army of India averaged 220 admissions per 1,000 of strength, and until recent periods there is evidence that the figures scarcely declined. Indeed, following the arrival of a large number of Europeans into the country, consequent on the mutinies, there was a very large increase in this class of disorders. So late as 1866, it may be seen from the "Army Sanitary and Statistical Report," that enthetic maladies supplied exactly the figure first mentioned towards the sum total of disease in India. There is, however, evidence of a diminution of syphilis in at least some parts of India. Thus in the Bengal Presidency, the ratio sank gradually from 250 per 1,000 in 1864 to 166 per 1,000 in 1867. It was not, however, until 1866 that rules for the prevention of venereal disease were *re-introduced* into Bengal military stations. The word *re-introduced* is used, because hospitals for the reception and cure of diseased women were established in Indian military stations in 1759, but abolished in 1830 by Lord William Bentinck. An outcry was raised against them on account of their presumed demoralizing tendencies, some even arguing that, instead of removing, they increased the evil! It is true, some of these lock-hospitals do not appear to have been properly conducted, and petty officials connected with them seem to have taken undue advantage of their position—consequences which under better regulations are, it is hoped, avoided.

The question of the morality of measures for the prevention of venereal disease, entailing the sanction of prostitution, is one on which there will always exist a difference of opinion. It

was probably this feeling which induced the Royal Sanitary Commissioners, in 1863, to accord special prominence to the fact that, after mature consideration of the various plans adopted in different countries, "we have arrived at the conclusion that none are so likely to diminish this great scourge of the soldier in India, as the re-organization of the measures formerly adopted in the three Presidencies, with any improvements which subsequent experience may point out as being required to meet the necessities of each locality."

The Commissioners also recommend additional means of cleanliness to be provided in all barrack lavatories, and also improved means of occupation, instruction, and recreation.

With reference to this subject, the following is quoted from Moore's *Health in the Tropics*, published in 1862. "It is a very general idea among soldiers, and indeed among those occupying a higher position in the social scale, that venereal disease, especially in its primary form, is easily and quickly cured. The sooner people are undeceived on this point, the better it will be for public health and morals, and the less likely will individuals be to incur danger The period has arrived when a false modesty should be avoided. The subject of syphilis should be explained to the soldier by the medical officer, and as at the present period the probability of non-contact is *nil*, prophylactic measures, as cleanliness, should be enjoined."

It has already been mentioned that lock hospitals were re-introduced into Bengal in 1866. Shortly afterwards an Act for the prevention of contagious diseases, making provision for lock hospitals in Madras and Bombay, was also passed. And Act XXVI of 1868 also enables municipalities to provide lock hospitals. At the present period, lock hospitals, entailing supervision over prostitutes, exist in all Indian military cantonments. We may, therefore, expect a diminution of venereal disease, although a total freedom from its ravages can scarcely be looked for. The higher means of preventing it, *viz.*, the elevation of the moral character of the soldier, the diminution of intemperance and its consequences, the employment of the European soldier and the encouragement of marriage, are doubtless most important. But they require a greater expenditure than the State revenue can afford, no less than a change in the habits, ideas and feelings of the soldier, which the present generation at least is not likely to see. For the prevention of syphilis we are therefore dependent on the lower means indicated.

The instruction, occupation and amusement of soldiers has received great attention. In 1860, the institution of the Outram Institute at Dum Dum was proposed. In 1861, rules regarding soldiers' gardens were published. In 1864, gardens were classed under two heads, small plots near the barracks, and larger ones at a distance. Sites, it was ordered, were to be selected by boards of health: the cost of first turning up and enclosing the ground to be paid by the Commissariat Department. The P.W.D. to make provisions for water supply, by a well for each company, or an aqueduct. Wheels and ropes for wells to be found by Government. Tools to be found by the Barrack Department, but to be repaired from the garden fund. Reading Rooms have at various times been erected in proximity to all European barracks. Skittle or Bowling Alleys, Fives Courts, and other means of recreation, have also been liberally provided, especially since the publication in 1863 of the Report of the Royal Commission appointed to enquire into the health of the Army in India. On the subject of occupation and amusement, the Royal Commissioners observe: "The men's amusements, such as they are, are all connected more or less with drink, and they are everywhere most deficient in amount." Hence workshops, soldiers' gardens, gymnasia, libraries, reading rooms and theatres are recommended. To quote the orders since issued on these different subjects would be tedious, but similar attention to that noted under the head of gardens, has been accorded to other measures. Hence such a scene as that depicted, as the daily means of occupation and amusement of Anglo-Indian soldiers, by the pen of Miss Nightingale and published at page 358 of the Royal Sanitary Commissioners' Report, need never now be repeated. Here we have the men represented as lying on their beds, in every state of listless indolence, smoking, sleeping, card-playing, wrangling, drinking, bartering, yawning. We do not mean to say that this is never the condition of an Indian barrack interior now, but we assert, that such need not be the case, that plenty of rational amusement and occupation is now provided for the men, and that the account of a soldier's day in India need not now be "bed till day-break—drill for an hour"—breakfast served to him by native servants—bed—dinner served to him by native servants—bed—tea served to him by native servants,—drink—bed—*da capo*." A certain amount of ennui, the consequence of climate and heat, is perhaps

inseparable from hot weather existence. But it is the soldiers' fault, and not that of the authorities, if this is not reduced to a *minimum*.

The employment of soldiers in different out-door trades has often been suggested, but unless in the hills, climate will ever forbid this means of occupation in India. In the hills, however, it is different. There Europeans may labour at out-door work to a very considerable extent. In 1867 during the hot season, 648 men of the 3rd Battalion Rifles were employed on the Murree and Abbotabad road. The total expenditure, including hutting the men and commissariat, was Rs. 77,208, and the value of the work done Rs. 59,043. But, as Colonel Maclagan stated, "the gain in health and welfare of the men has a money value much higher than the expense here shown to be caused to Government, independently of other great advantages attending the arrangement." The men were happy, enjoyed the life, and also benefited pecuniarily. They acquired habits of steady continuous exertion by wholesome employment in a bracing climate. They returned to their regimental duty in good health and strength, with acquired skill and practice in the use of tools which it is desirable all soldiers should be able to use. The Government of India considered the results highly satisfactory, and expressed an opinion that re-employment of the men on similar duty was highly desirable.*

The mortality among soldiers' wives and children has already been referred to, and the reasons of the continued large death-ratio pointed out. But during the decade, much has been done to ameliorate the condition of these classes. In 1861, it was ordered, that soldiers' children accompanying their step-fathers to England, should be permitted the usual orphan allowance if returning to India. In 1865, half rations were ordered for the orphans or widows of soldiers on staff employ, for the period to which children of private soldiers are so entitled. In the same year, quarter rations were admitted to children separated from their fathers, the latter proceeding on service or as invalids to hill stations, or the former being sent to a convalescent depot.† Afterwards it was ordered that whenever the exigencies of the public service required the separation of a man from his family, half and quarter rations should be issued to the women and children

* Supplement to the *Gazette of India*, p. 430.

† Governor-General's Order No. 604 of 1865, Military Department.

respectively.* The "subsistence allowance" granted to both women and children has also been almost doubled.

In 1860, the necessity for some better arrangement for the transport of troops was forcibly brought to notice by the melancholy voyage of the "*Great Tasmania*." This vessel, upwards of 2,000 tons burden, had been previously taken up by Government as a transport ship during the Crimean war, and was engaged by the Indian Government in 1859, when 1,000 men belonging to the 5th Bengal Europeans, 3rd Madras Europeans and 3rd Bengal Europeans, were embarked for conveyance to England. They were 154 days at sea, during which time 101 men died. The investigation of this mortality showed,—that the men were somewhat demoralized by absence of the necessary discipline; that proper care had not been exercised with regard to the supply of "kits" and bedding for the voyage; that overcrowding had existed on account of the insubordination of the men, and their refusal to go on deck; that the 5th Bengal Europeans had previously been tainted by scurvy; that the bread being stowed in iron tanks, had become damp and mouldy; and that the preserved meat and vegetable supply, as also the water supply, was deficient.

But the Indian Government was not long destined to depend on hired transports for the ordinary relief of European soldiers. After considerable opposition, the idea that a voyage round the Cape was a necessary acclimatising process for the European soldier exploded. The mutinies did much to dispel this long fixed theory, and the writings of various medical officers aided in the work. Moreover, economical considerations were also brought forward. It was stated, that instead of soldiers being three months *en route* to India and therefore useless, they might reach this country in one month, and thus two months' service be saved. Eventually, the construction of the present transport fleet was decided upon. The utility of these magnificent vessels, and the great use they must prove in quickly conveying the invalid from the tropics to a temperate climate, needs no dilation here. It is however stated that the system of discipline on board is too much after the man-of-war fashion for a transport service: and soldiers leaving at least one of the vessels, are said to have *groaned* rather than *cheered* on their liberation.

No subject, during the last ten years, has deservedly received more attention than the prevention of cholera, and although we

* Governor-General's Order No. 857 of 1865, Military Department.

have not yet succeeded in stamping out the disease, there is at least hope for the future from the results of recent procedure and investigation. The first action with regard to cholera, during the period under review, was taken in 1861, in the appointment of a Commission * “to enquire into, and report on, the “recent severe outbreak among the European soldiers at several “stations in the North-West Provinces.” During the whole of the hot season of 1861, cholera prevailed from Benares and Allahabad on the east, to the deserts of Rajpootana on the west, from a few miles north of Neemuch on the south, to Ferozpour, Umritsir and Lahore on the north, scarcely a military station, city or village escaping a more or less severe visitation. It was, however, at Meean Meer that the disease proved most fatal, apparently localised by the cesspools, the crowded barracks, and the condition of the water, which was said to be tainted by the sewage. It was, however, long before the Commission of Enquiry published a report, although to their investigations and recorded opinions, is supposed to be chiefly due the appearance, in 1862, of Sir Hugh Rose’s celebrated order, dated April 2nd. And this may be considered the most important step towards the prevention of cholera yet taken in India. The communicability of the disease, the tainting of grounds and buildings by the active principle of the malady, was authoritatively recognised, and *ordered* to be acted upon. The danger of permitting large bodies of men to remain breathing a cholera atmosphere in a too often crowded or indifferently ventilated dwelling was admitted, and the orders were given *to move out into camp* whenever epidemic cholera occurred. The most important paragraphs of this famous order run as follows :—

“4. As soon as any case of cholera is reported in the station, “the troops will be moved into camp, and no unfavourable condition of the weather is to prevent this movement being carried “out.

“5. The force will be broken up into as many detachments “as the number of the medical officers will admit, allowing “one to each party.

“8. It must be insisted on, that all discharges from the “stomach and bowels of the sick be instantly removed and “buried in pits.

* This Commission consisted of—Mr. Strachey, *President*.
 Dr. Linton, C.B., Insp. Gen. of Hospitals, B. F.
 Dr. McClelland, Insp. Gen. of Hospitals, L. P.
 Lt.-Col. Gawler, Offg. Dep. A. G., B. F.
 Major Stewart, Bengal Engineers.

" 10. Should cholera follow the troops, they will be moved short distances, at right angles if possible to the wind and track of the disease.

" 11. The breaking out of cholera in a regiment or station, is on no account to cause the suspension of the soldiers daily amusements or occupations.

" 12. The troops are not to return to cantonments until all traces of the cholera shall have disappeared."

But notwithstanding the unmistakeable language in which the above regulations are given, and notwithstanding the arguments upon which the necessity of movement are based, much disposition of evasion and cavil was displayed. It was hinted, that the famous order was simply "clap trap" for home consumption, as a sop to the party clamouring for sanitary reform, and that obedience was not intended. "Departments" hated the trouble entailed by moving European troops. Commissariat officers cried out about the difficulties of supplies and carriage, in which they were ably supported by civil officers, who were of course applied to in emergencies. The latter were not slow to show the hardship entailed on poor cultivators, obliged to bring out their carts and bullocks at perhaps the very period their fields required most attention. Doctors prophesied a greater mortality from sun-stroke and fever and dysentery, than from the cholera if left alone. Officers naturally did not admire the prospect of going under canvas during the rains or hot weather, and having the additional expense of maintaining carriage for an unlimited period.* In short, objections, both grave and trivial, were glibly advanced, and the majority, ignorant of the facts, arguments, and conclusions on which the order was based, regarded the procedure as simply a "sanitary vagary." Even the authorities in the Bombay Presidency did not adopt Sir Hugh Rose's regulations in their entirety. The Commander-in-Chief, with the sanction of Government, was pleased to publish a modified order, † requiring telegraphic reports on the appearance of cholera, on which, if considered necessary, orders for the march would be issued from Head-Quarters; but, generally, "this is not to take place without authority from the Head-Quarters of the Army." Happily,

* It is only right to mention that a cholera camp entails many expenses on the officers, who must keep up an expensive carriage in the way of camels or carts during the whole time, perhaps months, they remain under canvas, and for which no extra allowance is granted.

† G. O. C., No. 774, 5th July 1862.

however, no material alteration in the original rules was permitted; although modified from time to time, the principles involved, *viz.*, the communicability of the disease, and the necessity of separation and isolation of the sick were maintained, and the resulting benefits will presently be seen.

Another fruit of the cholera epidemic of 1861, was a report by Dr. Playfair on the epidemic cholera which appeared in the Agra Central Prison. In this paper, the author states that "cholera, if seen in an early stage and promptly treated, is generally under control." His great remedy is a revival of the bleeding practice of Twining, Annesley, and other older authors.

In 1863, we were favoured with a report by Dr. Murray, then Deputy Inspector-General of Hospitals, "on the attack of epidemic cholera in Agra of that year," in which the movements of troops were carried out under his superintendence. The artillery detachment moved out, and, crossing the river, after several changes of ground, entirely lost the cholera. The same result occurred to two detachments of the 23rd Fusiliers: Dr. Murray in this paper lays down the general rules of prevention as under:—

1. Separation of the affected.
2. Removal of the healthy from contaminated ground.
3. The early exhibition of remedies, with quinine in the rainy season.
4. The use of disinfectants, particularly newly made charcoal in the shape of smoke.
5. Strict attention to diet, cleanliness and ventilation.
6. The employment of native *shampooers* to wait on the sick.

This year also saw, long after the dissolution of the Commission appointed in 1861, the publication of the second and third sections of their report, with a preface by Mr. Strachey, who accounts for the delay by differences of opinion existing among the members. "These differences relate almost entirely to matters affecting individual officers; the questions at issue had no importance or interest for the public, and their discussion at the present time could throw no light upon the progress or character of the epidemic. It has, therefore, been thought undesirable to publish the first section of the report." The second section contains accounts of the progress of the disease at various stations, together with details of sanitary defects. The third, and most important portion,

contains "special measures for the prevention of cholera among "European troops," which afterwards, having been slightly modified by the Bengal Sanitary Commission, were republished in a separate form, and must now be regarded as the manual for the guidance of all officers during epidemics of cholera. It is herein insisted that, although general sanitary measures are most important, extraordinary precautions are required, and that observation of facts is the sole rational basis for measures of precaution. Civil authorities are made responsible for giving the earliest information of the prevalence of epidemic cholera to the Commandants of military stations. Communication with infected localities is to be prevented, encamping grounds to be chosen, but when in the vicinity of any station suitable buildings exist, they are to be occupied in preference to the location of the men in tents. But the most important modification of the order of 1862 is contained in paragraph 481, which runs as follows:—"All, therefore, which "need be laid down as an invariable rule is, that the particular "body of men among whom cholera has appeared in an epidemic form, must be removed from the cantonments. If, for "example, this body consist only of the inmates of some one "building, the measure need only be applied to them; if some "particular company or troop be attacked, it will be similarly "dealt with. A whole regiment, or the whole of the troops "at the station, need only be sent into camp, when it is found "that the measures adopted have not stopped the progress of "the disease, or there is reason to fear they will be insufficient."

But in carrying out the movement of troops, considerable discretion is to be allowed to local authorities. Less than the precaution described must not be taken, but when considered essential, the movement is to be extended. Cots are to be taken into camp, marches to be short, and similar rules to apply to women and children. Thus, while maintaining fully the principle of isolation and separation of the sick, and removal from affected localities, the amount of trouble and expenditure is reduced to a *minimum*, by merely insisting on the evacuation of those buildings in which cholera actually occurs. But a foot-note to paragraph 481 runs:—"For the word building, substitute room or "building"; and had this been adopted in the subsequent standing orders it would undoubtedly have been a retrograde step. Whenever cholera occurs in any building, particularly in one occupied by large numbers, the whole should be evacuated, and only re-occupied after thorough disinfection and purification. Walls, floors,

and punkahs, should be scraped and white washed ; wood-work should be re-painted ; furniture, punkah fringes and ropes washed. G. G. O., Military Department, dated 1st September 1864, to the Adjutant General of the Army, notifies the approval by the Government of India of the measures epitomised above for the prevention of cholera. It was, moreover, pointed out that, in selecting the sites for cholera camps, the ground should be visited during the rainy season, as the real suitability of any spot for the purpose can only then be decided,—a remark equally applicable to the selection of sites for cantonments, barracks, houses, or any other purpose.

Attached to the “ Measures for the prevention of cholera ” is a memorandum on its propagation and prevention by Dr. W. Budd, based on the contagious nature of the choleraic discharges. Isolation of the sick, and the destruction by chemical agents of the excretions, are the main points insisted upon.

In June 1863, Mr. Walker, Inspector-General of Prisons, North-Western Provinces, issued a well written circular,* laying down rules for the prevention of the spread of certain maladies in prisons. Relief of the jail from any excess of numbers is insisted upon as the primary step. Having got the prisoners out in camp, “ insist on their performing some work, in small bodies at a time if your guard is insufficient, but avoid the “ error of leaving them day and night lying in tents, tied up on “ the belchain.” If circumstances should prevent the removal of the prisoners, they are to be exercised in the open air every day. A section should be organized for night work, and crowding the hospital should be avoided by the discharge or removal of miscellaneous patients.

But the difficulty of procuring carriage for the removal of troops, on the sudden appearance of cholera being still felt, a standing order was published in 1864 (P. W. D.), permitting the hiring of buildings for the accommodation of troops on any emergency of the kind.

In October 1864, Inspector-General Dr. Murray published a circular, requesting information from medical officers regarding their experience on various points connected with the history and etiology of cholera. The intervals at which cholera appears at stations ; the course of the disease ; the period the disease remains dormant ; the effect of moving into camp and the subsequent effect on the health of the troops, were among the more important questions asked.

* Vide *Supplement, Calcutta Gazette*, p. 2433.

The year 1865 was rendered memorable by what was not inaptly called "The fatal march from Mhow." In April of that year, a company of artillery left the station named for Bombay, but near the Smirole Ghât, cholera in its worst form attacked the detachment, and its return was necessitated. Cholera at the time existed in the villages *en route*; the season was far advanced; the men, it was said, were depressed by the knowledge that their battery (one of the old Company's) was about to be broken up; and undoubtedly the parting glass had been taken more freely than perhaps is usual, and the soldiers were thus in a condition favourable to the reception and development of the malady, which unfortunately proved so fatal.

In 1866, we find the following order* issued under the sanction of the Bombay authorities:—"When it is found necessary on account of epidemic cholera to remove either troops or prisoners from the building which they have occupied to tents, the cholera patients should be encamped separately from all others, and when it is necessary to change ground, because fresh cases of the disease have occurred, the cholera patients should on no account be taken with the others to the new ground. The cholera patients, so left, should be conveyed to the cholera hospital tents, and not to a general encampment."

In August and September 1866, the subject of cholera was brought before a meeting of medical officers at Simla, Dr. Murray taking the leading part in its discussion.† Every hypothesis connected with the symptoms, treatment and prevention of the malady was considered *seriatim*, and the following positions received general assent:—1. The existence of a specific poison. 2. The variation of the symptoms with the intensity or quantity of the poison. 3. That the poison is of an increasing or propagating nature. 4. That the poison, being a foreign body must enter or be communicated to the system. 5. That the poison passes off with the evacuations. 6. And with the breath. 7. That the poison retains vitality for some time after leaving the system. 8. That the period during which vitality remains, is not known. 9. That cholera follows human intercourse on the line of commerce, and its arrival is often distinctly individualized. 10. That the season of localities regulates reproduction of the poison. (Thus the natural season appears to be in Calcutta, March and April; in Agra and the North-

* No. 94, G. G. O., 9th February 1864.

† The Simla Conference was not official, but assembled at the request of Dr. Murray.

West Provinces, June, July, August; in Lahore and the Punjab, August and September; in Mecca and Egypt, June and July; in France, autumn and winter; in England, summer and autumn.) 11. That crowds, whether in cities, fairs or otherwise, are favourable to the development of the activity of the poison. 12. That cholera frequently follows or accompanies famine. 13. That although soil retains the poison in a productive form, it will increase independently of land, as, for instance, on board ship. 14. That the human body is the ordinary channel by which it is disseminated. 15. That it may be conveyed in clothing.

With regard to moving troops, the following rules were generally agreed to by the members of the Simla Medical Conference:—

“It is important to determine the *time* for moving into camp. The *longer* the troops remain in cantonments after the disease has shown itself, the *more extensively are the men affected*, and the more likely they are to carry the disease into camp. It is not desirable to entail the trouble, expense, and exposure needlessly; but it must be recollected that *delay is dangerous*.

“If the epidemic be *approaching* the place; if it be *present in the neighbouring native city*—if *one case* appear at the *usual season* in the hospital or barracks, where it had been present the *previous year*; or should diarrhoea become prevalent at this time—*preparations* should be made to facilitate the movement into camp, and *enquiries* made regarding the supply of carriage, cots, &c.

“Should these *suspicious circumstances* become more strongly developed, the *preliminary camp* for two hundred men should be pitched.

“Should *two decided cases of collapse* appear, when the diarrhoea is prevailing, the companies to which these cases belong, should be *moved* that day, into the preliminary camp; and two or three days after, should the *diarrhoea continue* in the regiment, the two or three companies most affected should be moved out.

“This is a *medical question*, and the responsibility of the movement should rest with the senior medical officer at the station; as regimental authorities may be biased, and it is through that channel that distant authorities receive information.

“The Deputy Inspector-General of Hospitals should be in the station at an early period, if not already there; and on him should rest the responsibility of the *change to camp and the return* to cantonments when the attack is over.”

In 1866, Drs. Stewart, Goodeve and Dickson, the British Commissioners appointed to attend the Cholera "Commission Plénière," opened at Constantinople in February of that year,* communicated the conclusions arrived at to Lord Clarendon, by whom they were sent to the Government of India. Briefly, the results of the deliberations of the Constantinople Cholera Commission were as follows :—

That the discharges of those in a state of developed cholera, or in a state of choleraic diarrhœa, become the chief means by which the cholera poison escapes from the system, and by mingling with food or water diffuses the disease.

That cholera may be transmitted by exposing persons to the atmosphere of buildings or vessels, which have been occupied by cholera patients, or to the emanations from clothes, bedding, or other articles, which have been in contact with diseased individuals, or soiled by discharges.

That exposure to atmospheric air lessens the force of the contagious matter, and *vice versa*.

That there is no reason to suppose that cholera is communicable by actual contact.

That the period of incubation, counting from the time of reception of the poison, is short. It may manifest itself either by fully developed cholera, or by diarrhœa with more or less choleraic symptoms. Difference of opinion exists with regard to the actual period—the majority of the Commission thinking that after diarrhœa has lasted eight days, the case may be removed from the class of cholera patients.

On the above conclusions, the British Cholera Commissioners suggest the following measures in case of ships arriving from infected places :—

1. No persons to be allowed to land, previous to efficient inspection by medical officers.

2. The healthy passengers to be removed from the ship and isolated for a period of five days, at the end of which time they should be again inspected, and if found without choleraic symptoms receive *pratique*.

3. All persons with diarrhœa or cholera at the time of arrival, or at any period of the detention, to be isolated. Cases of diarrhœa to be retained under observation.

They further think that the complete disinfection of the

* The Report of the Commission—a volume of 900 pages—was not published till 1868.

effects of persons coming from contaminated places should be insisted upon.

In conclusion they repeat, that, whatever measures are undertaken, the communicability of the disease should be recognised; involving the necessity of complete isolation of all choleraic patients from healthy individuals, the destruction or disinfection of all wearing apparel that may have been in any way contaminated by the sick, the complete disinfection by chemical means of all discharges derived from them, the evacuation if possible of contaminated ships and habitations of all kinds, and their complete purification.

The year 1866 was further marked by a grand durbar at Agra, to which the chiefs of Rajputana, Central India, the Panjab, &c., with their miscellaneous following, marched long distances. For some months previously, isolated cases of cholera had occurred in various parts of Rajputana. The camp of the Agent Governor-General for Rajputana, in marching up from Aboo in the middle of September, took a circuitous route through the Marwar territory in order to avoid infected localities. This camp arrived at "Halena" near Bhurtpur, on the 27th October, where two cases of cholera occurred. The camp then divided, and marched to Agra in two divisions. On the 3rd November the Agent Governor-General, with his personal staff only, entered the Agra cantonment, but the next day the disease appeared both in this camp, and in the other division, left some miles behind at Buroonda. The disease subsequently obtained a footing amongst both European and native troops during the durbar, as well as among the native population of the city, and in the camps of the various native chiefs assembled at Agra. In the military camp, and in the city, the total deaths did not exceed 7 and 64 respectively, but the number dying from cholera, mostly among the followers of the native chiefs, could not be ascertained and never will be known. In the Marwar camp, for instance, some 8,000 people were all huddled together, either *sub Jove* or in very small tents or "pals." Here cholera was reported to prevail or not, as the prospect of the Marwar Chief obtaining a very high seat in the approaching assembly appeared promising or the reverse. When it was supposed His Highness would attain the highest seat, cholera was declared not to exist in the camp. When it was thought Marwar would be seated below Jeypore, or some other obnoxious princeling, cholera prevailed, and the propriety of leaving the place was discussed. Of course cholera

was present during the whole period, but the sufferers were not always brought forward. And all who know the condition of a native camp, without order or regularity, will readily admit the ease with which the sick might be secreted, in the recesses of tents, under heaps of clothing, hidden away in howdahs or in palkees, taken off to other localities, from any one not possessing full authority over the whole.

A full report of the arrangements for police, conservancy and sanitation, adopted at the great Hurdwar fair of 1867, was published at the time.* Owing to the mortality which had occurred from time to time at other similar large gatherings in various parts of India, and also to the Constantinople Cholera Conference having called attention to the generation or at least outbreak of cholera at such times, it was decided, with the full consent of the Lieutenant-Governor of the North-Western Provinces, that as far as conservancy and sanitation generally could avail, every means should be used to prevent disease. The great Hurdwar Fair of 1867 commenced on April 12th, and early in January of that year a meeting of officers connected with the irrigation and police departments was called, for the purpose of devising measures of protection and prevention. Arrangements were made to prevent over-crowding at the bathing places; to prevent different sections and castes of Hindus meeting on their way to or from the holy ghâts. Temporary bridges were established from the mainland to Roree island. Barricades, chains, and other means of protection for the bathers were erected, and a camping ground, 27 square miles in extent, was prepared for the reception of visitors and pilgrims. Some idea of the magnitude of the arrangements involved may be formed, when it is recollected that during the ten days the fair lasted, 2,855,966 people were at Hurdwar and that bands of *faqîrs*, mustering above 12,000 men each, with horses and elephants (one band having as many as fifteen of the latter animals), claimed the right of procession through the town of Hurdwar to the bathing places.

The sanitary control was invested in Dr. Cutcliff, who based his conservancy regulations on the dry earth principle. Refuse was buried in trenches, or burnt in furnaces. The cantonment being in blocks, latrines were constructed for the use of people occupying each division. An ordinary latrine occupied 60 by 20 yards of ground, and in this,

* *Gazette of India*, August 23, 1867.

trenches were dug, each visitor being required to use the dry earth himself. In some few localities, where rock or stone composed the surface, earth was procured for deodorization and the whole carted away. The furnaces for the consumption of garbage, were situated in such a direction that the smoke was carried away from the camp. Hospitals, with native doctors, were also established at various points. *Dooleys*, or rather *charpoys* on poles, were provided for the removal of the sick or wounded, and dead bodies were taken to the sacred burning ghât; a native medical subordinate being detached for the purpose of seeing thorough cremation carried out. In case of contagious disease, a special locality was pointed out for burning dead bodies on. Everything, in fact, which forethought could suggest, appears to have been adopted for the prevention of disease at Hurdwar.

The gathering of the multitude at Hurdwar is thus graphically told by the Inspector-General of the Medical Department, Dr. Murray, then Inspector-General of Hospitals, Upper Provinces.* “A mass of people nearly as numerous as the population of Scotland, converging from the whole Hindu world of Eastern Bengal, Southern India and Western Panjab, was located on a bare plain on the banks of the Ganges on the 12th April, 1867. On that day they performed their allotted ceremonies and then dispersed. The solid stream of pilgrims, on foot, in hackeries, or on camels, which flowed along the road past Murree (80 miles distant) for nearly a week, was like the crowd of a London street.” There was a story in circulation, that this would be the last of the great Hurdwar fairs, as the place had lost its sacred character from the Ganges having been diverted into the Ganges Irrigation Canal. The health of the crowd remained remarkably good up to the 11th of April. Previous to the 12th, there was no sickness. Neither had cholera occurred at Hurdwar since 1857. The whole country was indeed perhaps more than ordinarily free from the disease. But after the bathing on the 12th, cholera broke out, the commencement of the disease being thus described by Dr. Cutcliff:—

“In March, the temperature had been unusually high, and the weather then remained fine and pleasant up to the 11th of April, which was a cloudy close day, with the usual wind blowing upwards to the hills,—till the afternoon, when a heavy storm

* Report on the Hurdwar Cholera of 1867, *Gazette of India*, November 1867.

“ of thunder and lightning coming from the West broke over Hurdwar, where two men were killed by the electric fluid, and four others severely burned. Heavy rain fell, and continued all night. The 12th was the great day for bathing, and the pilgrims who had been wet for twelve hours, began before the dawn of day, to stream off in thousands to the sacred ghât. The rain continued to fall, though now only lightly : nor did it cease till the evening, when just before sunset the clouds broke, and the sun for a short time appeared. But the pilgrims had been out for 24 hours, and after bathing in and drinking the much polluted water at the ghât, a vast number must have waited in a state of fatigue till the sun came out, ere they could have got any dry clothes on their bodies. On the following day, April 13th, eight cases of cholera were sent to hospital.”

The questions still remain to be satisfactorily answered,—Was the cholera generated at Hurdwar? Did it pre-exist on the spot, or was it imported? Against the latter presumption there is the fact that the disease was not prevailing in the surrounding country, and also the length of time which, if imported, elapsed during incubation. That cholera was not generated *de novo* at Hurdwar, is rendered probable by the fact of perfect conservancy and cleanliness having been enforced. But, as Dr. Murray observes, there is no valid reason to question the probability of the seeds of the disease, deposited on some previous occasion, having been brought into action by the rain. The fall of rain on the night of the 11th was evidently the exciting cause, bringing into action the germs of the specific poison of cholera, for the growth of which the dense mass of shivering pilgrims formed a rich soil. How long the poison of cholera may remain dormant has not yet been ascertained, but instances are not wanting in which persons living on ground previously tainted have taken the malady. The disease has even been known to re-appear in buildings occupied the previous year by cholera patients. There are certain soils, which preserve rather than oxidize organic material, and such influence may be exerted on the deposited cholera germ. As instances of cholera apparently hidden in the soil, the following may be quoted :—Some few years ago a party of prisoners were employed making a road in the Guntoor district, and in cutting away the soil, came upon a number of remains of persons who had died of cholera in the famine year of 1838. The disease broke out with great violence among these

workmen.* A number of coolies employed on railway works in the neighbourhood of Salem, in cutting through an old burial ground, came upon a spring of apparently pure water. Many who drank of this water were seized a few hours afterwards with cholera of a very severe type. Such instances of cholera originating after opening up old burial grounds, will recall to mind Dr. Gibb's observation of the occurrence of small-pox at Quebec, immediately following the opening of a small-pox cemetery two hundred years old!

Again it is equally demonstrable that cholera has frequently occurred in India after what may be designated unseasonable showers. In 1865, as mentioned by Dr. Murray, the severe attack of cholera at Mahadeo, in the Panch Murree Hills, originated after rain. In May 1867, the female pupils of the Secundra Orphanage were drenched by a sudden storm of rain, when taking their usual walk. During that night, and the two following days, 31 out of 168 were attacked with cholera, and 15 more during the following six days. On the 19th May there was a heavy storm at Peshawur, and on the morning of the twentieth, cholera broke out with great intensity among the European troops. Dr. Murray adds:—"In the six cholera epidemics which have been under my management at Agra, it appeared about three weeks after the rains set in."

The influence of the sudden change of temperature on the human frame is too well known to require notice here, and nowhere is this influence more marked than in India. It is therefore not irrational to conclude, that the sudden rain at Hurdwar, may have acted in two different manners in exciting the outbreak of cholera; *first*, by predisposing the systems of the people to its influence, by aiding other causes in lowering vitality; *secondly*, by giving activity to dormant germs of cholera poison, lying in, or on, the surface of the ground.

Whatever may be advanced against the assertion that cholera is always communicated by human intercourse, there is no doubt of the fact that it was so disseminated by the pilgrims leaving the Hurdwar festival. For a most elaborate tracing of the routes the dispersing multitudes took, and for the account of cholera as it originated in their track, we are again indebted to the Inspector-General, Dr. Murray. There are 597 reports from districts and towns on the line of returning pilgrims, showing 22,403 deaths from cholera. "There are numerous illustrations

* 2 *Madras Journal of Medical Science*, January 1862.

“ in these reports of the manner in which the disease was transmitted to families on the arrival of relatives, to people of villages communicating with the pilgrims, to those who ate the food left by the pilgrims, or travelled in the same carriage with pilgrims and being afterwards affected with the disease. * * The pilgrim stream carried with it cholera, which lined the roads with victims, whose funeral pyres studded the surrounding fields, or whose bodies were thrown into the canal, or collected by the police and buried. The disease was communicated to the neighbouring towns and villages, and the pilgrims carried it with them to their homes, over the whole of Hindustan.” At Murree, 500 miles distant from Hurdwar, at Kohat 543 miles away, at Peshawur 561 miles, cholera appeared among the residents, within a short period after the disease had been marked among returning pilgrims.

In October 1867 an order was published, directing that all ground used as cholera camps should be ploughed up after evacuation by the troops. It was also ordered that the ground, especially latrine trenches, within the limits of an encampment, should not be disturbed during occupation, but all refuse, &c., is to be buried at a distance of at least 500 yards. Cholera encampments, after being ploughed up, are not, except when unavoidable, to be re-occupied within twelve months. It was also notified,* on the recommendation of the Sanitary Commissioner for Bengal, that all buildings or articles contaminated by cholera should be fumigated with sulphurous acid in preference to any other disinfecting agent; that floors should be dug up, and fresh earth placed over them; that roofs should be washed with a solution of Mc.Dougall's powder, and the walls freshly leaped. The last-named process, the Sanitary Commissioner believed to be more efficacious and economical than lime-washing. Where the floors are permanent structures, they should be washed in the same manner as the ceiling.

One of the most important papers regarding cholera which has ever appeared, is that “on the removal of troops during attacks of epidemic cholera,” by Dr. Murray, dated 18th June 1868. In this document the Principal Inspector-General stamps with the authority of prolonged experience, of a lengthened careful attention to the subject of cholera, and of professional and official position, the doctrine of the communicability of the disease. Having personally superintended preventive measures, during seven different epidemics, Dr. Murray

* P.W.D. Circular, No. 115, dated 17th December 1867.

records his deliberate opinion of the necessity of removal from infected localities—a procedure which not only benefits the affected, but also withdraws a continually increasing source of danger from those who remain behind. With regard to the objection of sickness arising from placing men under canvas at unsuitable periods, it is remarked :—

“When a regiment arrives at the encamping ground before the tents have been prepared in the hot season, or is pitched in low marshy ground in the rains, makes too long marches or commits excess, extraordinary sickness may be expected to ensue. To infer that an increase of sickness was solely owing to the removal, is to ignore these facts, and the after effects of cholera or its treatment, and also the ordinary increase of malarious disease at that season.” Should there be an excess of the average sickness of the station, the increase may fairly be attributed to the movement. On the other hand, if there be a diminution of the ordinary sickness of the station, it may as justly be attributed to the removal.

And with regard to expense, Dr. Murray shows by statistical evidence that the rate of mortality in stations that have been frequently attacked both before and after the systematic use of removal, has *diminished more than one-half*, viz., from 7·09 to 3·23 per cent. Thus the saving of life even in a pecuniary point of view amply compensates for the outlay.

In 1868 was also published a summary of results of personal experience of medical officers as to the best means of treating cholera. The opinions of thirty-five medical officers are here given, one column being devoted to preventive or prophylactic treatment. Attention to the general principles of hygiene, with the use of quinine, are the sanitary preventive measures generally recommended.

In 1868, the voluminous report of the International Sanitary Conference of Constantinople appeared. The principal conclusions arrived at have already been referred to. The Congress stigmatized India, “as the birth-place of cholera, and its permanent home,” * from which it is conveyed chiefly by pilgrims to other countries. They pronounced that cholera is “not a native of Europe and that it has no spontaneous origin there.” And they appear to suppose that the disease was unknown in India previous to the end of the last century. In both their conclusions, however, the Conference seem to us to

* Proceedings of the International Sanitary Conference, p. 478.

be mistaken. D'Orta, a Portuguese physician, published at Goa, in 1563, an account of cholera, and did not even hint that the disease was novel. Mr. Gaskoin has recently translated from the Portuguese a notice of cholera near Calicut in 1503. In 1709 the Jesuit Père Passien, writing from Hooghly, mentions *mordechi* as the disease of that part of India. It is also on record that an epidemic resembling cholera broke out in Aurangzeb's army before Bījapur in 1689, to which Grant Duff says the usual native name for cholera was applied. To the assumption that one part of India, to wit, the delta of the Ganges, is the birth-place of cholera, and its only permanent home, there are many and fatal objections. A disease which has prevailed with equal epidemic intensity, under the most varied conditions of climate, at the level of the sea and in the Himalayan ranges, under the sun of the tropics and among the wastes of Siberia, can scarcely be described as the "native of Lower Bengal." The doctrine of a disease being able to *disseminate* itself in any climate, but to *originate* only in one, cannot be received. The theory is not in accordance with the laws affecting other zymotic maladies. Every one now admits the existence of *typhus* and *typhoid* fevers in India, and their spontaneous origin in this country has never been questioned. As cholera prefers India, however, so they have a preferential site in the colder countries of Europe. Again yellow fever, unlike cholera, will not spread itself out of the tropical zone. A vessel affected with this malady at Havannah or Jamaica, by running north invariably loses the taint in a few days. Yellow fever, indeed, will neither originate, nor disseminate, out of the tropics. Yet cholera, in defiance of general laws, is supposed to do one, but not the other! Were the matter not one of practical importance, it might be left as decided by the Constantinople Conference. But if, on the assertion of the majority of the members of the said body, we admit that Asiatic cholera is "never developed spontaneously, "has never been observed as endemic disease in Europe, but "that it has always entered from without"—if we admit these dogmas as correct, we not only ignore facts connected with the etiology of the affection, but also adopt a very dangerous theory. If the public are brought to believe that cholera is always introduced from without, internal sanitary arrangements will soon be regarded as less necessary. Instead of trusting to home sanitation, an impracticable system of quarantine will be the reed on which public health will lean. The Commission properly

insisted on increased attention to sanitation in India, and especially in Bengal, where they consider cholera may be attacked at the only focus of origin! But for the protection of other countries, they had nothing better to advise, than a large and impossible system of quarantine. Not only did they recommend surveillance over all vessels entering the Red Sea, but should cholera break out at the Hedjaz, they required the temporary stoppage of maritime communication with Egypt and the Mediterranean. And as regards the land, they demanded a line of sanitary posts along the whole Turco-Persian and Russo-Persian frontiers!

In reviewing the general conclusions of the Congress, Major Malleeson, then Sanitary Commissioner for Bengal, remarks that it would be out of place to express any opinion of their accuracy, or as to how far they are borne out by experience in India. We have no such feeling of diffidence as that confessed by the military sanitarian mentioned. As regards India being the only birth-place of cholera, and as regards the spread of the disease being prevented by the large quarantine system suggested, we firmly believe that the Constantinople Commission are entirely mistaken. Facts and experience are both against their conclusions.

In a memorandum on the report from the Madras Cholera Committee, the Army Home Sanitary Commission remark, that the Madras Committee open up the whole question of cholera as it occurs in India, in relation to opinions set forth authoritatively by the Constantinople Conference.* The views then enunciated divide themselves into two classes, (1) those more or less hypothetical, (2) those strictly practical. The hypothetical views, on which the Conference proposed to rest one branch of sanitary procedure, have not met with universal acceptance; such, for instance, as the relation which cholera excreta bear to the spread of cholera, and the part which movement of the population plays in spreading the disease. But the practical measures, as cleanliness, fresh air, pure water, wholesome personal hygiene, are shown by experience to be useful.

In the present state of the question, therefore, no greater service could be rendered than carrying out a rigid system of sanitary police in a well known endemic locality, and marking results—the sanitation to include drainage, cleanliness, attention to the state of the adjacent country, and to the habits of the

* Supplement to the *Gazette of India*, May 1869.

natives, as regards food, disposal of excrementitious matter, and the state of the water supply.

The Constantinople Cholera Congress was, however, useful in further authoritatively directing attention to the Indian fairs, religious or otherwise, as the places and times at which cholera originates.* That this fact had already been recognized in this country is however evident from the foregoing, and from other published writings.† But it apparently required the addition of pressure from without, to induce any action on the part of Government, which might be misconstrued as an interference in religious matters. But in 1867 the Secretary to the Home Department, addressing local administrations, remarks : ‡ “Recent experience has made it abundantly manifest that serious epidemic disease is very generally engendered among the large multitudes of people, who periodically assemble at the various centres of pilgrimage in India, and that the pilgrims not only suffer largely, but propagate disease throughout the country on their return journey. Indeed the Medical Conference which assembled last year at Constantinople, believes it to be established, that cholera at least emanates from India only, and the Conference indicates the large periodical assemblages at fairs and pilgrimages as one of the most probable sources of its origin and the most ready means of its propagation.....When, therefore, epidemic disease prevails in any locality in which pilgrims are about to assemble, it is of course the plain duty of the local Government to prevent their collection by every means in its power. But the Governor General in Council believes that more than this can be accomplished, and although nothing is further from his wishes than to interfere in any way with the religious feelings of the people, His Excellency nevertheless thinks that the people of the country generally should be made aware of the serious risks they run, and dissuaded and discouraged, as far as is practicable, from making pilgrimages.....His Excellency also desires that some system may be devised, whereby, at all places of pilgrimage

* Report of the Constantinople Conference, p. 480.

† Vide Dr. Moore's *Health in the Tropics*, p. 185, in which cholera at the fair of Punderpore (Bombay Presidency) in 1860 is described. On that occasion “had bullets been flying about, the results would not have been more fatal.....and to the horrors of the place must be added the horrors propagated from it.”

‡ No. 55-3764, dated 21st August 1867, from the Secretary to the Government of India, Home Department.

“and at all large fairs, sanitary arrangements may be immediately made, and carefully supervised.” In a separate communication from the Foreign Department, His Excellency in Council further stated, that he was “satisfied that no measures which the British Government may adopt within the territories under its control, can prove effectual, unless they are supplemented by corresponding arrangements in the neighbouring native states”; and therefore political officers were requested to ascertain what arrangements the several durbars would consent unanimously to adopt.

In response to this latter communication, we have only at hand the reply from the Agent Governor-General for the States of Rajputana, then the late Colonel Eden. This experienced officer was of opinion, that before direct interference could be successful in preventing cholera, it would be necessary to render the chiefs and people acquainted with the most recent and generally received views regarding the malady. Dr. Moore, Rajputana Agency Surgeon and Superintendent of Medical Institutions in the native states, was therefore requested to draw up a short account of the disease, showing its method of dissemination, and mentioning the practical rules tending to check its spread. This was published in pamphlet form in two vernacular languages, and was extensively distributed throughout Rajputana. The preventive measures insisted upon were,—1. Scrupulous cleanliness, especially as regards food and drink. 2. Immediate destruction of all choleraic discharges. 3. Destruction of infected clothing, and fumigation of houses by burning sulphur. 4. Isolation of sick. 5. Necessity of a sufficient diet during long journeys, as pilgrimages. 6. Importance of medical treatment in the early stages. More particularly addressed to the chiefs, were remarks on the necessity of aiding the Supreme Government in carrying out measures for the prevention of the spread of cholera, *first*, by as much as possible discouraging persons, not possessing suitable means, from undertaking pilgrimages; and *secondly*, by guarding their frontiers against either the importation or export of the malady. In conclusion the opium, pepper and assafoetida pills, as prescribed by Dr. Murray, were recommended as an efficacious medicine, the ingredients of which are obtainable in every village.

In 1869, a cholera hospital was proposed for Calcutta, and the formation of such an institution was sanctioned by Government. Hitherto native cholera patients at Calcutta, taken to the *Medical College Hospital*, have been treated in the same wards

with other sick. Cholera patients in the *European General Hospital*, as in all the other presidency towns, have been treated in separate buildings, or, at least in separate wards. And the result of the two procedures is very remarkable. Since the year 1861 in the Medical College Hospital 66 patients, admitted for other diseases, have been attacked by cholera, of whom 55 died. In the General Hospital, 13 cases only occurred, of whom 3 died. As will be evident from the foregoing observations, for some years past it has been the endeavour, in all mofussil or up-country stations in India, to isolate the cholera-stricken, and it appears strange that in the metropolis of India, ruled by a municipality sufficiently enlightened to maintain a Health Officer, the segregation of cholera patients at the principal hospital should not have been insisted upon. The presidency towns, owing perhaps to the fear of interference with the liberty of the subject, where Europeans, Parsees and educated natives mostly congregate, are indeed in some matters behind the outlying stations. In the latter it was directed in 1869, that whenever cholera appears in an epidemic form among the general population of military stations, tents or temporary sheds or huts are to be placed in the outskirts of cantonments, and a liberal establishment is granted for their maintainance.

In 1869 it was also ordered, that when circumstances permitted, a military cholera camp should be formed 50 miles away by rail from the station attacked. The advisability of this procedure as likely to infect distant localities, may be questioned, but doubtless the order was not authoritatively issued without due deliberation by those competent to offer advice.

A Government resolution of the same period prohibits the conveyance by passenger trains of corpses, when death has been caused by cholera, or other infectious or contagious disorders.

In 1869, local governments and administrations were instructed to institute experiments for testing in some well selected civil stations Dr. Pettenkofer's theory regarding the origin and propagation of cholera. This was in connection with the despatch of Drs. Cunningham and Lewis in the previous year, by the authorities in England, for the purpose of investigating the German Professor's theories in the "home of cholera." The theory referred to may be briefly epitomized as follows:—The germ of cholera is developed into infecting matter in the subsoil; after development the infecting matter ascends, and produces the disease; the infecting matter may enter water and render it poisonous. The conditions of the subsoil rendering it a suitable *nidus*

are, (1) a certain degree of moisture, neither very wet nor dry (2) the presence of organic matter. In any permeable soil it almost necessarily results, that organic impurities are washed down through it, and accumulate in the subsoil water, or in other words over the first impermeable layer. The point therefore to be ascertained is as follows: Is the development and decline of an outbreak coincident with alternations in the amount of subsoil moisture? And to determine this, the level of water in the wells must be daily noted. But those conversant with outbreaks of cholera in India will readily admit, that neither the greatest amount of dryness, nor the most extraordinary saturation of the soil with water, has appeared to influence the malady. It has prevailed with equal intensity in the hot weather when the wells are at the lowest, and in the monsoon when the level of the water was that of the soil. It may therefore be anticipated as probable, that no particular results will follow the investigation into the connection of cholera with the level of subsoil water.

But the most important event as regards the sanitation of cholera during the year 1869 was the publication of Inspector-General Dr. Murray's "Report on Epidemic Cholera." In this, perhaps the most valuable paper on the subject ever passed through the press, are epitomized the opinions of five hundred medical officers serving in India; while the individual views of the author are also expressed with the authority of an experience and a position attained to by few, and with the modesty of a devoted investigator into facts. A belief in the communicability of the disease by human intercourse forms the basis of Dr. Murray's preventive measures. The beneficial effects resulting from the removal of troops during epidemics of cholera are dwelt upon. The formation of a preliminary camp, on the first case occurring, is recommended, and actual removal after the fourth case. With regard to sanitary conditions, Dr. Murray remarks that, however deficient they may be, they cannot induce cholera *per se*; the germs of the disease must be imported into the locality, but, when once so imported, it will spread among the inhabitants in inverse proportion to the purity of the air they breathe, of the water they consume, and the food they eat. It is however difficult to understand why, as cholera has once originated, it should not again originate *de novo* under similar conditions. This must either be allowed, or the belief must be admitted that cholera germs exist everywhere and are liable to be excited into action at any time.

On the publication of Dr. Murray's report the Governor-General in Council caused the thanks of the Government of India to be conveyed to the author in the following terms. "I am to request that you will convey to Dr. Murray the thanks of the Government of India for his able paper, and for the zeal with which he has undertaken the collection and analysis of the opinion of the medical profession in India; and devoted his time, attention, ability, and protracted experience to the laborious consideration of a question of such momentous importance to the well-being of all the inhabitants of India, native as well as British. * * * * The Governor-General in Council does not venture to pronounce on the degree of weight and authority which should be attached to it, but, as a careful analysis by a professional man of Dr. Murray's special experience and long study of the disease, the Governor-General in Council is satisfied that its promulgation cannot fail to stimulate all those whose duties call them to combat cholera to an earnest study of its nature and treatment."

And a leading article in the *Indian Medical Gazette*, dated August 1869, after noticing Dr. Murray's lengthened services as a military medical officer on active service, and as a civil medical officer engaged in sanitary progress and in professional research, thus concludes:—"If ever officer earned a C.B. for service before the enemy, John Murray was the man; but C.B's were not then granted to medical officers. His services then and since would now warrant a higher title, and we still hope that Government will not forget to reward its honest servant and labourer in war and peace, of thirty-six years' standing, by some more honourable and lasting token than mere thanks." And in this opinion there are few who will not acquiesce.

As was mentioned in our observations on Sanitary Commissions, the first real improvement in conservancy—and perhaps indeed it may still prove the *greatest* improvement—was made when Hathaway introduced the dry system into the Panjab jails, just previous to the mutinies. The Panjab method consisted in the absence of all lime from the privies (which, it was found, combined with urinary salts liberating ammoniacal gases) with a flooring of dry earth for a depth of six inches, so that any defilement might be quickly and easily removed. The Prison Committee tried the experiment with success in the Alipore Jail and Calcutta House of Correction, recommending its adoption in barracks, hospitals, and other public institutions, also urging

the abolition of lime, charcoal and ashes. The system was also adopted in the jails of the Bombay Presidency by Dr. Wiehé, who inspected the prisons of the other presidencies during an official tour in 1863-64.

And doubtless this would have been the conservancy system throughout India, had not Moule's dry earth method been proposed immediately afterwards. On this conservancy system so universally adopted throughout British India, we venture to quote from an article published by Dr. Moore in the *Indian Medical Gazette* under date April 1st, 1868. After demonstrating from the works of Budd, Simon and Murchison, that typhoid, pythogenic or enteric fever may be propagated by fæcal material, the writings of Threich, Pettenkofer, Acland, Snow, Carpenter, Allison, Routh, Sutherland, Bidie, Budd, Simon, Gibb and Parkes are referred to, as proving that cholera poison is contained in choleraic discharges. Similarly, the researches of Von Siebold, of Kuchenmeister, of Nelson, of Cobbold, and Humbert are quoted, as demonstrating that certain kinds of *entozoa* flourish in some part of their existence in fæcal discharges. "There are then three diseases, " *viz.*, typhoid fever, cholera, and worms, known to be disseminated by the medium of fæcal material. Hence arises a very "grave question, as to the advisability of the much vaunted "dry earth system of conservancy.....There is every difference "between a mere deodorizer and a disinfectant. There is reason to believe that earth does not act with any great certainty "in the latter capacity. It is well known that some soils, such "as clay and alluvium, retain organic matter for a lengthened "period in an undecomposed form. It is on record, that some "years ago a body of prisoners were employed in making a road "in the Guntoor district, and that in cutting away the soil they "came upon the remains of a number of persons who had died "of cholera during 1838, and that cholera immediately broke "out among the workmen. Again, a party of coolies, employed "on a railway cutting near Salem, opened a spring of very "clear water. Those who drank of it, were seized in a few hours "with cholera of a very severe type. In this instance the "railway cutting passed through an old burial ground. "Again, a well known author, Dr. Gibb, informs us, that "an epidemic of small-pox at Quebec followed, and by "first commencing among the workmen appeared directly "attributable to the opening of a small-pox cemetery 214 "years old."

That the molecular germs of disease may remain for an unlimited period with vitality unimpaired, cannot be denied. Seeds from Pharaoh's pyramid have germinated. There are forms of vitality capable of existing in boiling water, and we can preserve the poison of small-pox, or *vaccinia*, unimpaired for an indefinite period. And what is true regarding the *materies morbi* of one disease, is equally correct with respect to others. Instead of earth acting as a destructive agent to the germs of cholera, typhoid fever and entozoa, there is every reason to believe that at least some variety of earths will exert a preservative tendency. And if this is the case, the wholesale burial of human ordure, some of which must necessarily be diseased, now going on under Moule's system of conservancy, is, most certainly, simply storing epidemic poisons which will probably be turned up hereafter.

An eminent Indian Officer, Inspector-General Hare, lately provoked a discussion, by reading a paper on the dry earth system of conservancy before the "Metropolitan Association of the Medical Officers of Health."* From the remarks then elicited, it appears that there is a growing feeling that the application of ordure to agricultural purposes is not altogether free from objection. Dr. Thudichum stated:—"It must be taken "as certain that *fæces* are of no value to agriculture whatever, "except on a sandy soil." Mr. Girdlestone remarked, that "sewage has not been successful in producing anything but "rye grass, which from its nature cannot be made into good "hay." Dr. Tripe observed, "that it is questionable if the "milk produced from sewage was perfectly wholesome." In India again we find Dr. Mouat stating, with regard to the fever in Bengal jails, that the immediate condition which makes this fever contagious, consists in the noxious exhalations from the large amount of putrifying excreta buried in jail gardens.† And in relation to this part of the subject, it cannot be ignored, that the natives of most parts of India object to the use of human ordure for agricultural purposes. And this antipathy arises from a rooted idea that good grain is not produced of such manure.

A consideration of the sanitary aspects of the subject leads us to doubt if the present extensive application of the dry earth system of conservancy is advisable. Could it be rendered

* *Lancet*, January 4th, 1868.

† *Report on Jails in Bengal for 1866-67.*

quite certain that none but *healthy* fæces would be mixed with dry earth, and either buried or laid on the surface as manure, the procedure would probably be as good as any other method of disposal of the material. But any such assurance is manifestly impossible. Choleraic, typhoid, or dysenteric fæces, or evacuations containing myriads of entozoic ova, must, from time to time, be stored a foot or so below the surface of the earth, or otherwise spread on the surface. In public institutions, during seasons of epidemic disease, fæcal matter will probably be more or less destroyed, or at least disinfected, by such agents as Condry's fluid, or carbolic acid. But these measures cannot always be practically enforced. Some fæcal matter is certain to escape disinfection, while in the case of persons affected with *entozoa*, such precautions would not be employed. Moreover, it has never yet been satisfactorily proved that disinfectants destroy the mortality of the molecular germs of disease. Even admitting this property of disinfecting agents, and also that all diseased excreta could be destroyed in public institutions, it can scarcely be hoped that the general public would resort to disinfection, previous to the use of the dry earth.

Again, the expense of the dry earth system, applied to large numbers, must ever be enormous. As was proved at Wimbledon in 1858,* unless the fæcal material is *smothered* in earth, the latter is not even a deodorizer. Carrying the immense mass of earth and fæces away is costly; places of burial are not always procurable, and in a short time the mass of refuse from a city would surround it with hidden collections of filth. It was such considerations that induced no less an authority than Pettenkofer to declare against the cumbrous dry earth system as applied to multitudes. Similarly, experience has proved the general impracticability of the method as applied to cities in India. Copies of a very important memorandum by the Army Sanitary Commission, on a report and order of the Madras Government, have latterly been forwarded by the Secretary of State to India. The great value of this document lies in its authoritatively showing the shortcomings of the dry earth system of conservancy. It emphatically points to the system as a failure, practically and economically. The dry earth system, it says, "deals only with one part out of one hundred and ninety-one of the total injurious barrack and hospital refuse, while it makes no provision for the removal

* *Lancet*, April 17th, 1869.

"of surface or subsoil matter." In other words, "for every pound of human excreta removed under the dry earth system, there are in every well-regulated establishment about 190 lbs of fluid refuse, which must be otherwise disposed of." And to have two systems of cleansing—a foul water system and a dry earth system—would, the Commission state, simply be paying for two systems when one would answer. If all the excreta, solid or fluid, are to be carted away, this must be done at a cost ten times greater than that which would be necessary, if all the excreta were removed by drains.

But while agreeing that Moule's system is too cumbersome for Indian cities, and also holding that the systematic burial of fæces is in many instances simply a storing of disease, we are altogether opposed to any drainage system for India; unless indeed in a locality, as near the sea, where an unlimited amount of water can be procured. Often for nine months, no rain falls in most Indian stations. The use of drains is therefore almost impossible. The system would require excessive expenditure in the storing of water alone. At the same time all closed drains simply become abominations in this country. For our own part we believe that the combustion of all refuse matter and fæcal material in furnaces properly placed and tended, would be the most economical and unobjectional method of Indian conservancy.

Before leaving the subject, it may be permissible to remark that the deodorizing powers of earth have long been known, although to Mr. Moule belongs the credit of the presumed beneficial application of the property for the purposes of conservancy, as now so extensively practised. It is a saying, "there is nothing new under the sun." Earth was known and *noticed* as a deodorizer, long before Mr. Moule introduced his patent earth closets. Every cemetery is indeed proof of this quality of earth. Dr. Hathaway's Panjab dry system has already been referred to. The deodorizing powers of earth have been made use of by the Italians for ages. "Whenever in that country night soil is removed, it is customary to mix it with dry earth. A hole is dug in the immediate neighbourhood of the cesspool, and a hole drilled low down into the latter. As the ordure or sock flows, it is mixed with and deodorized by earth, and taken away without unpleasant effluvia."

Matters are now very much changed since the period, some forty years ago, when Dr. James Ranken wrote, "medical police is quite unknown in the Hon'ble Company's Service." The system

of sanitation is now such, that if thoroughly carried out according to existing orders on the subject, everything will be done that is calculated to ensure the health of the inhabitants. That there are numerous Indian stations so badly situated, and with evils of such magnitude inherent in the site or in the relative position of bazars, towns or villages, that no method of sanitation can render them healthy, may be readily admitted. But the rules now in force are studiously devised to secure the desired end, and when disease does occur more severely than ordinary, it not unfrequently happens that some sanitary error of omission is found to exist.

Previous to 1860, sanitary measures had been carried so far as to place the control of sudder bazars under the Cantonment Magistrate, or as formerly designated in the Bombay Presidency "the bazar master," who was also responsible for the cleanliness and sanitary condition of the precincts. Regimental bazars, on the other hand, were under the charge of the Quarter-Master of the corps, who of course was accountable to the commanding officer. Regimental lines and their immediate locality were also under the same authority. Roads, drains and bridges, were under the engineer department, and with regard to the erection of buildings and the appropriation of unoccupied ground, it was laid down that "the health and comfort of the troops are to be held as paramount considerations, to which all others must give way." Previous to 1860, the use of bazar public latrines had also become general, and a great step in advance was made, when at Agra cultivators were induced to utilise the manure. The position of slaughter-houses, stables, the size of officers' compounds, the height of fences, the prohibition of holes in which refuse or stagnant water might collect, were also the subject of regulation. In Bengal, committees were assembled quarterly, for the purpose of reporting on roads, drains, and sanitation generally, the reports being forwarded to the Quarter-Master General of the army. In addition, medical officers were required to furnish periodical topographical reports, specifying the existence of any cause of disease, and the Superintending Surgeon on his visits was called upon to do likewise. It was also permissible for, or rather imperative on, any medical officer to report the existence of sanitary defects.

Since 1860, the following are the principal additions which have been made to the system of cantonment sanitation. In 1861 it was directed that medical officers, making reports on matters affecting the health of the troops, should furnish a duplicate to

their commanding officers. In the same year, medical officers were reminded of the duty of vaccination in regimental lines, and new regulations on this subject were published in the Bombay Presidency. Unfortunately, however, the prophylaxis was not made compulsory on the women and children of the sepoys. By G. G. O. 1494 of 1861, the senior medical officer in each station was required to prepare a summary of the returns, with notes on the prevalent diseases, with a view to prevention, for the information of the commanding officer. Revised instructions were also issued to medical officers as regards framing annual reports, and the duties of Deputy Inspectors-General were more distinctly defined. A monthly sanitary report in the War Office form, being answers to printed questions, was also required. In 1862, the Commander-in-Chief of the Bombay Army, calling attention to the regulations making commanding and medical officers jointly responsible, remarked that by attention to the regulations, reference to superior authority would frequently be avoided. In 1863, the Blue Book containing the report of the Royal Sanitary Commissioners appointed to enquire into the sanitary condition of the Indian Army was published, the 32nd recommendation of the Commission being "that the sanitary duties of regimental, garrison, and inspecting medical officers, prescribed in the new Medical Regulations of October 7th, 1859, be applied, or adapted, to all stations in India; and that properly trained army medical officers of health be appointed to this service at the larger stations."

In the same year, orders were issued for the formation of Cantonment boards of health, to whom, according to the Public Works code, the barrack department entrusted with the executive duties of conservancy is responsible. Regimental conservancy, however, remains under regimental authorities. On the final separation of the Indian and British medical services, it was decided that the senior local medical officer of both services should act as sanitary advisers to the officer commanding, on all matters relating to the two departments.

The position of burial grounds in new military stations is now fixed by regulation. In many of the old stations and in most native villages, both native and European grave-yards are very badly situated with reference to sanitary principles. During the investigation, in 1863, into the causes of the epidemic fever devastating the Hooghly districts, the condition of burial grounds and places of incineration was especially condemned,

And until recently, the want of attention to European station grave-yards has frequently attracted attention. In 1863, a Commission of European and native gentlemen was appointed in Bombay for the purpose of ascertaining the practice relative to burials among the various communities in Bombay, and of inquiring whether any detriment to health arose from such practices, and of devising by what means the evil might be diminished. At that period, indeed, the condition of burial grounds in Bombay was disgraceful. The Muhammadan burial ground at Sonapur had been encroached upon by the sea, "leaving a surface from above downwards of some ten or twelve feet in extent, through which bones of all descriptions protrude, demonstrating how, year after year, body has been laid upon body, to form the now existing mass of human putridity."* The Christian burial ground, and the Portuguese grave-yard, in the immediate neighbourhood, although not thus disturbed, were in bad sites; while the Parsee "Towers of Silence" then, as now, occupied one of the best positions in the island. Here, in modern times, the vulture preys upon the dead body, as in heathen mythology the bird is reported to have feasted on the living. "The Towers of Silence are immense structures of variable diameter, raised twenty, thirty or more feet from the ground, in the centre of which is a well, covered by an iron net-work frame or grating. On the latter are placed the corpses of the Parsee population, and before the mourning relatives have left the ground, hundreds of carrion birds, of voracious vultures and hungry crows, are quarrelling, fighting, clawing, like so many ornithological devils, at the specimen of humanity exposed to their ravages. The delicate Parsee female, the portly merchant, the withered sexagenarian, are all thus disposed of, and we are credibly informed that two hours after the deposition of a body in the 'Towers of Silence' bones alone are to be found, which are eventually thrown down into the well enclosed in the tower. At the same time, the loathsome carrion birds, with their bald heads and hideous claws, arrange themselves in rows on the summit of the towers, bloated and surfeited from their ghoul-like feast, secure in the knowledge that by waiting where they are, a repetition of the festival will take place to-morrow."† And of the truth of the above description we can vouch from personal knowledge. But the practice of thus

* *Bombay Saturday Review*, 1862.

† *Bombay Saturday Review*, December 1862.

disposing of the dead, revolting as it may appear to us, is certainly not more dangerous to the health of the living, than that method of burial, which permits the bodies to be uncovered either by the washing of the sea, or by any other cause.

As one result of the Bombay Committee, a patent *Incinerator* was proposed for the purpose of effecting thorough combustion of Hindu bodies. But this community persists in the ancient plan of the funeral pyre, although it frequently happens that lack of wood, or rather of the means to purchase wood, results in incomplete cremation.

In 1864, rules regarding burial grounds in the diocese of Calcutta were published by the Public Works Department, the chaplain and commanding officer being made responsible for the condition of these localities.

In 1867, a remarkable article written in Hindi appeared in the *Dacca Prokash*, condemnatory of the barbarous practice of taking sick people to die on the banks of the Ganges. It was observed that, in addition to the chance of recovery being lessened by exposure, the cruelty of the custom was not exaggerated from the fact that those who did not die were ever after looked upon as outcasts. It was also implied, that this religious rite was not unfrequently made the means of removing infirm, and troublesome, or obnoxious relatives. Opinions regarding the legality, cruelty, or necessity of the procedure according to Hindu religion having been obtained from various authorities, both European and native, the Secretary of State recorded his conclusion, agreeing with that of the Government of India, that it would be well if the practice were to be discontinued, but that "it is not desirable to have recourse to special legislation for its suppression."

We occasionally hear much of the disgraceful condition of grave-yards in India, and sensational articles have, from time to time, appeared in the Indian journals on this subject. But it is rarely that Christian graves are desecrated. The surface may be untidy, and the grass may be encouraged to grow for the chaplain's horse. But our system of deep burial and substantial coffins effectually protects the corpse. It is, however, far otherwise in Muhammadan or other native grave-yards. There the jackal, or pariah, finds little difficulty in disinterring the slightly covered dead. Hence sights revolting to the senses and injurious to human health, are common in such localities. Individually, we hold that the more cleanly and salutary method of disposal of the dead is by burning, provided the combustion be complete, and such a

result is simply a matter of a plentiful supply of fuel. During the cremation of a corpse no unpleasant effluvia is perceptible, and all that remains is a small heap of whitened ashes. We are, however, aware of Christian prejudices against the procedure, not less bigoted than those held by Hindus against burial. While therefore the State still permits each sect to dispose of its dead in any manner most in accordance with its ideas and customs, the desirability of such disposal being complete is unquestionable. And in this matter sanitation has scarcely commenced.

Among the numerous means which are required to be adopted to preserve the health of Europeans in India, there are none of such vast importance as the establishment of hill stations, or sanatoria. As the Psalmist prized his mountains at a high value—"he brought them within the borders of his sanctuary, even to his mountains which he purchased with his own right hand,"—so should we regard the hill ranges of India. Medical men, indeed, from the time of Lind, have not hesitated to recommend for the habitation of Europeans in tropical climates such elevated localities "where the heat of the day seldom exceeds 80°, and the cold of the night is about 54°."

The establishment of the first sanitary station in India appears to have been due to the recommendation of Dr. Gibb of the Bengal Army, who as early as 1820 was exerting himself in this direction. This officer was ably seconded by Julius Jeffreys, who in 1824 wrote his essay "On the Climate of the Hill Provinces of the Himalayas." In consequence of this essay, the attention of Government was more immediately directed to the subject, and the stations of Simla, Mussourie, and Landour were shortly afterwards selected. Since that period up to the commencement of the decade, the number of hill stations, civil or military, in Hindustan had increased to nearly 30.

But much disappointment was experienced with regard to the climate of elevated regions. Too much was expected from them. There was a tendency to overrate their influence on disease, and it is only recently that the true value of Indian hill climates is becoming fully understood. They should be regarded as the means of *maintaining* the health of soldiers, not as curative agencies. The true value of the climate of the Indian hill ranges and elevated regions is *preventive*, not *curative*. Here are numerous maladies either not benefited or actually

increased by the hill climates. The same, indeed, may be said of the rapid change from the tropics to England. Hill stations hitherto have been principally made use of as places to which sick Europeans might be sent. This is altogether a mistake. It is by the location of healthy men on the hills that the benefits of their climate will be obtained. And this is a very different matter to the simple use of the site as a sanitarium or summer residence. We fully believe that a regiment, fresh from England, placed on the hills, would enjoy the ratio of health appertaining to similar classes in most European temperate climates. The system of the men would not only be exempt from the debilitating effects of heat, dry or moist, during the hot or monsoon seasons, but would also experience the bracing effects of the cold weather—an advantage hitherto too much ignored, when forming estimates of the value of hill climates. But to ensure success, it is a *sine quâ non* that healthy men are so located. Thus to situate regiments debilitated by a prior exposure to the heat of the plains, and with many of their members, as must be the case, more or less diseased or prepared for disease, is equivalent to increasing sickness and mortality. The influences of rapid changes of temperature, especially from heat to cold, are physiological facts which cannot be ignored either in the consideration of the advisability of permanent hill stations, or when sending invalids to such localities. The hill stations should rather be made the intermediate step between service in a temperate climate and on the burning plains of Hindustan. This is the proper use to which hill climates should be put.

The objections which have been raised by certain authors, that troops located on hill ranges, if called upon suddenly for service in the plains, would suffer greatly from disease, we consider to be altogether untenable. It can scarcely be denied that troops fresh from the hills would enter on a campaign with a greater amount of physical force and vital energy than others already debilitated by the heat, malaria and discomforts of life in the plains. It would, indeed, take a considerable time to induce that condition of debility and proneness to disease among the former, in which the latter would commence operations. It is true that instances occurred during the mutinies, of regiments descending from the hills and suffering a great mortality on the plains. But these corps had been previously weakened and predisposed to disease by a residence in the plains, a condition which their removal to the hills only tended to confirm. Again, the

regiments in question, *viz.*, the 1st Fusiliers, the 2nd Fusiliers, and the 75th Foot, were hurried to the lowlands, without time for ordinary marching arrangements, at the very worst season of the year. They had to make forced marches to Delhi, they left their water-carriers behind, and they entered a country afflicted with epidemic cholera. No wonder sickness occurred in these corps! Here we had soldiers, some of whom had been only one month at the hills (75th Regiment), and who must necessarily have been cachectic from former residence on the plains, suddenly called upon to make the most excessive exertions in the worst season of the year, and under the most disadvantageous circumstances. As an almost inevitable consequence, they suffered from disease, and, under similar conditions, similar maladies might be expected. But even should great mortality occur on the sudden removal of regiments for service on the plains, we maintain that the death-ratio, for any lengthened period, would be infinitely less than the ordinary rate obtaining on the plains. But it does not follow that regiments suddenly moved from the highlands *must* suffer from extraordinary sickness. The probability is that such would not be the case. They would take the field fresh in health and spirits, and not, as their comrades from the low lands, deteriorated and exhausted by the heat and malaria of the plains. "The majority would require months to bring them to that state of *cachexia* which they would have acquired on the plains before the order for active service arrived." As a rule, the European enjoys the best health during the first year of residence in the tropics. Degeneration, the result of heat and malaria, is a more or less rapid process, commencing from the time the white man first lands in India. We believe that if it were possible to transport a European regiment from England to this country in a day, use it in a campaign, and then send it back, the mortality in that regiment would be less than in one of the so-called acclimatized corps—equal care and sanitary arrangements being of course applied to both bodies of men.

We are thus urgent and decided in the expression of our opinion, because we believe the hill ranges of India have not hitherto been made that use of, which the welfare of the soldier, or indeed the economical holding of the country, demands. As Sir Randal Martin long since remarked, "the hill ranges have excellencies peculiar to themselves," but regiments still remain on the burning plains, even within sight of the hilly tracts. And not only so, but there is every probability that the position will

be indefinitely protracted. At some fifty places in the plains, palatial double-storied barracks are rising, upon which some five millions have already been spent, and on which it is intended to expend eleven millions. This work is, in our opinion, a huge mistake. The erroneous idea has prevailed that the health of soldiers is to be secured by lodging them in massive structures. But we are altogether opposed to this theory. We hold that, compatible with protection from weather, sun and rain, the less massive a soldiers' barrack may be, the more likely it is to prove a healthy residence. Indeed, we go further and submit that a change from one locality to another would be advisable, and even if this entailed the desertion periodically of temporary barracks, and the erection of new ones of the same class, the expenditure would not amount to the millions required for the upper-storied palaces now in course of erection. Ere long, it will be found that no immunity from disease is afforded by these magnificent barracks, and when too late, the error now being committed will be confessed. It is lamentable that some of this money, now being devoted to barracks on the plains, has not been expended in rendering hill stations habitable. The money would be much better invested in the latter requirement. It is equally lamentable that the mistaken notions expressed by various authors, as that the troops would suffer if brought down to the plains, have resulted in the determination to keep so many troops on the plains. For even admitting such suffering, the sickness or mortality would be extraordinary and exceptional—not ordinary as now.

Of course political necessities must ever forbid the evacuation of certain stations by European troops. There are strategical points which must be so garrisoned at whatever cost of money or life. But on the other hand, there are many places where the presence of Europeans, formerly necessary, is not now required. And the number of such stations will increase as a net-work of railways is spread over the land. There can be no doubt that at least half the European army might be located on the hills, without danger to the stability of the empire.

Early in the period under review (1861), a volume was published under the authority of Government, entitled "A Report on the extent and nature of the Sanitary Establishments for European Troops in India," but which is in reality only an account of such stations in the Bengal Presidency. In this volume also numerous localities are indicated as fitted for the residence of Europeans, among the more important of which may be mentioned Cheerat for Peshawur troops, the Cherra

Poonjee Hills, Gurhwal in the Himalayan range, the Khasia Hills, Puchmuree, Parisnath, &c. Little, however, appears to have been effected during the decade towards the occupation of any of these or other ranges as preventive sanitary stations—that is, as localities to be occupied by healthy men, not sick or convalescents. Subathoo, Dugshai, Kussowlie, and one or two others, now remain the only hill stations of the Bengal Presidency (including of course the North-West and the Panjab in the term) at which a regiment of Europeans can be located. Similarly, Madras only possesses Ootacamund, and Bombay no station of the kind. Small sanitary stations as Bulsar on the Guzerat Coast, Ghizree near Kurrachee, Taraghur near Nusseerabad, and Mount Aboo, are certainly to be found in the latter Presidency, but the two first are not hill stations, and the latter only would afford space for a regiment. A proposal, however, to place a full regiment on Mount Aboo, using the hill as the preparation for the plains, was latterly negatived by Government on its presumed unhealthiness based on a mistaken appreciation of statistics and sanitation.

It would appear that sanitation in hill stations has always been more backward even than on the plains. It seems to have been presumed that hygienic precautions were less necessary at a few thousand feet greater elevation. Confidence was placed in a naturally good climate, and the assistance of sanitation ignored. It was forgotten that, in the elevated regions of India, while the cold is not sufficiently intense to check putrefaction, the heat is not great enough to act as a preservative agent, as it frequently does on the plains, where bodies of animals and other materials dry up like mummies, no decomposition taking place. Similarly, the urgent necessity of draining a hill station was not unfrequently derided. Those thus acting forgot that mountain ranges are composed of rocks, in the hollows and valleys of which disintegration and decay of vegetable products have caused deposits of rich soil of a very porous description; and that water percolating through this sponge-like mass, lodges in the cavities of the rocks, from which there is no escape except by evaporation. Lastly, some hill stations being under civil, not military, control, and only resorted to during the hot season, is another reason why sanitation has been delayed in such localities. Persons arriving from the plains into a temperature 12 or 15 degrees lower, finding themselves free from the plagues of heat, flies, and mosquitoes, able to obtain refreshing sleep at night and to take exercise by day, imagine the change

delightful, and the climate not to be improved by sanitary measures.

In 1861, writing of the condition of Ootacamund, Dr. Mackay reported :—"Every convenient bush is made use of to deposit filth under. Should the preparation for its reception continue in the way of a disregard of all sanitary arrangements, there is every reason to fear that cholera will some day exhibit its virulence on the Neilgherries, as it has in other temperate climes.....The station is divided by a deep valley, a large portion of which is filled with water forming a lake. At the upper extremity of this, the large station bazar is situated: the houses there are crowded together; those in the lower street are built close to the water, many of them on a foundation formed by the rubbish thrown out from the houses above and the filth washed down by the rains from the upper street. With every natural facility for doing it effectually, drainage has been totally neglected, not only in the bazar but throughout the whole station.....In short, the whole station is a strange mixture of neglected compounds, bogs, and neat flower gardens. The sweepings and refuse of each dwelling are thrown where they can be conveniently disposed of. It is argued that the station has been healthy: that such things are better left as they are: that no injurious consequences can result in this region!"

According to Mr. Grant, writing in 1852, nothing could be worse than the state of the conservancy at Simla. The smells along the by-paths were described as most disgusting from the accumulation of human ordure, offal and dead animals. Ten years later, 1862, Dr. Clarke wrote :—"There is no conservancy here, and neither the local nor municipal authorities appear to have instituted any measures for providing for a complete system of drainage. If, in years past, the welfare of the community had been duly considered, some authority or other might have prevented the growth of the bazar to such an enormous and unnecessary extent. It is now a great central evil, militating against the sanitation of the station, and instead of being, as it should be, a clean, regularly-built native city, it is an unsightly collection of houses.....and radiating from it in all directions are drains and cesspools offensive and filthy to a degree."

Of Nynee Tal it was stated in 1861 :—"If any one doubts how unhealthy Nynee Tal is becoming, let him go into the grave-

“yard, and count the number of new graves, and then let him go into the soldiers’ hospital, and see the pale, yellow faces of men in whom hope has died away Another great nuisance of Nynee Tal I have alluded to—I mean, the rank state of the lake and the jungle round the lake. To walk round the lake on the lower mall is quite enough to give a weak man dangerous fever—so great is the malaria.” And in another place it is said that “the conservancy arrangements of Nynee Tal have hitherto been extremely bad.”

Of Mount Aboo it was reported in 1862:—“Thus, therefore, it may with truth be stated, Mount Aboo presents most of the essentials for a sanitary station. I regret, however, being obliged to repeat the statement made in my last annual report, that the labour of man has not developed and increased the advantages and capabilities of the locality, and that sanitary science and medical hygiene are not yet made available to the extent which, I again respectfully submit, ought to have been the case. If matters are allowed to continue as they are, future medical officers will have to report, not a mild, but severe type of malarious fever; not isolated cases of typhoid, but epidemics of that disease; not immunity from cholera, but its ravages on the excreta-loaded ground.”

Now, all the foregoing refers to the state of the localities mentioned eight or nine years back. But that no very great improvement has yet taken place, is evident from the following. As regards Ootacamund, a memorandum by the Army Sanitary Commission at home on a report on the sanitary condition of Ootacamund, dated 22nd April 1869, shows how much more difficult it is to remedy sanitary evils than to prevent them. “Ootacamund occupies a healthy locality, especially selected on this account as a sanitarium, at an elevation of 6,000 feet above the sea level. It has nevertheless become so far *used up*, that fatal typhoid fever has appeared among the residents as an endemic disease. Medical officers assert that the conditions have progressed from bad to worse, culminating in a state of matters which threatens not only to rob the station of the character it has enjoyed as the leading sanitarium of India, but to make it dangerous for invalids to resort to it at all.”

As regards Simla, in 1867, we find Dr. Ross, then Surgeon to the Commander-in-Chief, writing that the existing sanitary defects had been often brought to notice, but that it may still be said of Simla, as of Rome in the present day, she will

"deny the existence of disease until it has gained the "upperhand and there is nothing to be done but succumb "to it, and then on the first symptoms of relief go back "to her old ways, equally incapable of learning from the "past or providing for the future." In 1868, Dr. De Renzy made startling revelations with reference to the impurity of the water supply. In 1869, Dr. May stated the water of Simla is naturally the most pure, while the most impure is consumed. In 1861, Dr. Murray pointed out the cause of the diarrhoea so prevalent at Simla to be *local*, arising from the water drunk, which is chiefly surface water drained through dense vegetation with imperfect conservancy. In 1869, the water derived from the same source is still consumed, the reservoir containing "fæcal matter, bones, old shoes, sardine "boxes, and preserved-soup tins."

And the prophecy regarding Mount Aboo has also been literally fulfilled. Since the remarks relating to this hill station were written in 1861, malarious fevers have continued, typhoid types have not been unknown; while during the year 1869, epidemic cholera visited the locality which was formerly totally free from this scourge.

In 1869, the attention of the Panjab Government was drawn to the defective sanitary conditions of Murree. The Panjab Sanitary Commissioner pointed out the want of suitable latrines, the overcrowding of the bazar, the absence of a properly regulated slaughter-house, the want of arrangements for filtering the water of public reservoirs, as the most pressing sanitary requirements. The Lieutenant-Governor urged that these matters should receive the most earnest attention of the Municipal Commission, and requested a report on the action taken. And, with a view of raising funds for the purposes indicated, any reasonable increase of taxation would, it was intimated, be sanctioned.

And so on might be quoted *ad nauseam*, regarding most hill stations in the country. Government, it must be confessed, are anxious and willing to improve their sanitary conditions, and do so effectually in the military stations. In other localities the desire is thwarted by the action of self-interested municipalities, or by the obstinacy and ignorance of local officials.

After the transfer of India from the Company to the Crown, the subject of colonization was again revived, and afforded an opportunity for the expression of very contradictory opinions

on the subject. Those having a practical acquaintance with the country and climate, held that colonization of the Indian plains by Europeans was impossible. Others, having merely a book-knowledge of the country, or impressions derived from a cold-weather trip, expressed opposite views, declared that the dangers of the climate had been exaggerated, and called loudly for an unlimited number of "Edens" on the waste lands of India, "which only required labour to convert them into smiling gardens." But it appears to be now generally admitted that the plains of Hindustan can never be tilled by European labour. Even those, who, ignoring statistical and authentic data, based their opinion of the practicability of colonization on the reputed healthy appearance of indigo planters, now recollect that indigo planting is not *colonization*; that living in a good house, and superintending a large number of Indian coolies, is not the hewing of wood and the drawing of water of the colonizer's life. Both statistics and independent observers agree in the conclusion, that the mortality of Europeans in India increases in direct proportion to age, length of residence, and nature of occupation. If we refer to tables 4 and 7 of the report of the Royal Commissioners appointed to enquire into the sanitary state of the army in India, we find the death-rate, after the first year, gradually increasing with length of residence; but in a ratio much greater than in other countries. The statistics also of Ewart, Waring and others, point to a similar result. In his evidence before the Select Committee on Indian colonization in 1859, Sir Ranald Martin adds the weight of his opinion against the possibility of Europeans living as colonists on the plains. Dr. Moorhead insists on the degeneration, the result of heat and malaria, which commences in the system of the European from the day he first enters the tropics. Dr. Chevers is decided against the colonization of the plains. Dr. Moore writes:—"Acclimatization, as regards an Indian sun, is simply impossible. Exposure, instead of hardening the system, has a contrary effect, and the longer Europeans remain in the country, the more they feel the effects of the tropical sun. Men, with a larger amount of strength and vital energy than others, can bear exposure and effects of heat longer than those not so gifted; but the deteriorating process, though slow, is nevertheless certain, and if acute dysentery, epidemic cholera, ardent fever, or sunstroke, do not some day suddenly destroy, insidious malarious disease, *cachexia loci* or *splenic leucocythemia* sooner or later results." And not

only do these climatic conditions affect *all* Europeans, but their *progeny* is also subjected to similar influences, which act even more powerfully on the young. Not a single reliable fact has yet been adduced, evidencing that the European race can be continued on the plains of India even for a few generations, without admixture of Asiatic blood. All authorities, indeed, agree that not one pure descendant of the Portuguese, once so numerous and powerful in India, can now be found. It would, indeed, appear to be a universal law of nature, that the inhabitants of one zone shall not flourish in another. Captain Hall, the Arctic traveller, tells us that Esquimaux, brought to a temperate climate, invariably sicken, and often die from consumption, if not returned in time to their ice-bound homes. Similarly, the mortality of negroes in New York has latterly been double that which affected the class, before freedom caused them to move from the sunny, swampy south. Climate affects even the lower animals. It was remarked as far back as Henry Marshall's time, that domestic animals of colder climates, dogs, cows, sheep, horses, all sicken and die, if exposed to the climate of a tropical zone. If not exposed to vicissitudes of weather, deterioration with ultimately similar results takes place, instead of rapid mortality.

But it has been argued that, as both the Anglo-Saxon race and the Aryan Hindus are descended from one common stock, so both classes should be equally able to inhabit a tropical climate. Setting aside the fact that they are not so able, the extreme weakness of the above argument may be easily exposed. The Aryan Hindus were not brought to India by overland steamers, nor even by sailing vessels round the Cape. They descended through centuries of time over the slopes of the Hindu Kush, and, gradually mixing with the aborigines of the land, doubtless became altogether changed in habits, ideas, manners, customs, mental and physical constitution, by the influences of change of food and change of climate. Buckle has well shown how such conditions act on a people submitted to their operation. In a country blessed with more rain than now falls on Hindustan, with a tropical sun over-head, a virgin soil, and abundance of forest-trees destroying malaria, the Aryan Hindus had little else to do but scatter their new found food—the rice—on the bosom of the earth, and enjoy the *dolce far niente*, until the ripening ear aroused them to the necessity of collecting their crops. In so mild a climate, the slightest structures sufficed for houses, and the smallest amount of covering for raiment. And were Anglo-

Saxons subjected through an indefinite period to such influences, the probability is that they would gradually be acclimatized, but would become altogether changed in the process. They would in fact become Hindus, and lose the characteristics of Europeans.

As no action has of late been taken in the matter of the colonization of the Indian plains, it may be considered that in the foregoing remarks we have been combating a shadow. This is not, however, altogether the case. An agitation regarding the colonization of Indian waste lands occurs periodically, and erroneous impressions of the practicability of the step are abroad. Anything, therefore, tending to set the matter at rest, cannot but be worth the trouble of saying.

The question of Europeans living and flourishing as colonists in the more temperate climates of the hill ranges is altogether a different matter. The proposition of free grants of land has again and again been made in favour of men who have done effective service, and who desire to turn Indian colonists. The scheme, as recently set forth by an anonymous author in Madras, is indeed a repetition of the suggestions for "military colonization" so often before mooted. It has been the opinion of some of the ablest writers on Indian subjects, including the late Sir Henry Lawrence, that it would be both politic and practicable to establish colonies on the slopes of the Himalayas, where soldiers, on retiring, might be induced to settle down in peaceful pursuits. The policy of the arrangement, the advantage to Government which would accrue from the presence on the hill slopes of a number of military colonists available for active service on any emergency, is sufficiently evident. And the visionary spectacle of smiling Anglo-Indian villages, with the accessories of a green, a church tower and a school, are sufficiently alluring. But the practicability of the scheme, or even its possibility, is by no means so assured. Granting the climate to be suitable, the great majority of European soldiers, who have served their time, are not fitted for the duties of colonists. Neither their habits nor physical condition would at all qualify them for the new life. As a recent writer observes:—"A British soldier, who has been accustomed to be looked after all his life, is a helpless being when he has to look after himself"; and if, as would probably be the case as the result of previous service, he had become degenerated or actually diseased from the effects of heat and malaria, the probabilities of success would be reduced to a minimum. Military colonization cannot, indeed, be regarded as offering a fair chance of success.

There remains, then, colonization by arrivals fresh from Europe. It was mentioned above, that the soldier would probably fail, even granting the hill climates to be suitable to his temperament and constitution. But it cannot be asserted *ex cathedra* that even the hill climates would admit of the perpetuation of a healthy and vigorous European stock. The question has not yet been decided by experience. And the opinions of those best qualified to judge are, on the whole, unfavourable. Sir Ranald Martin, in his answers before the Select Committee of Colonization, stated that Europeans might flourish in the hills "to a certain extent not yet determined". Battie, before the same Board, "had no doubt a race of persons well off in life would be continued in the hills"; but whether they would deteriorate under the most favourable circumstances was a question "he was not prepared to answer. "Nothing but time can solve that question." Dr. Chevers, than whom no authority is entitled to greater respect, is very decided on the subject. "To become enterprising colonists on the slopes of the Ghats and Himalayas, they must be a robust, vigorous, intelligent race, capable of maintaining our wealth and our empire equally by commercial industry and by force of arms. It is more than doubtful if the race could be perpetuated at all; but if it could, would not their children and their descendants, reared as exotics on the summits of isolated mountains, apart from the whole bustle, traffic, trial, struggle, society, and novelty of the great world, in which, from the cradle to the grave, the minds of the rest of mankind are daily educated, become a puny, spiritless race, scarcely capable of self-support, and therefore miserable in themselves and burdensome to the State?" Dr. Moore also observes:—"Whether European progeny would retain their characteristics, if obliged to undergo the exposure and labour consequent on tilling the ground of even hill ranges, can only be determined by time and experiment. With constant infusion of new blood and due attention to sanitary principles, such might be the result."

To the uncertainty regarding the action of climate, must be added the doubt whether colonists in the hills would be pecuniarily successful. There would be no extensive grain cultivation. The nature of the ground would forbid this source of profit. It is questionable, indeed, if colonists could grow grain sufficient for their own consumption. As the climate permitted, such branches of industry as the cultivation of

tea, cinchona, coffee, vines, oranges, and olives, would be available; but even in the pursuit of these occupations, the men must descend into lower ground than they would fix their habitations upon, and they must often visit malarious valleys, from which it is undoubted their health would suffer.

During the last three seasons, European soldiers have been employed with great benefit to their health on road making in various parts of the Himalayas. And this has been brought forward as an argument that colonists would be equally fortunate. But it must be recollected that soldiers sent upon such duty have everything provided for them; the means of sustenance not only brought to their doors, but placed on the table before them. These road-makers were not called upon to descend into malarious valleys; their time of labour was regulated with due reference to a hot sun; they were not under the necessity of facing the monsoon rains, nor the severe cold of winter; they were under effective sanitary control, and in charge of their own medical officers. The comparison of men in such favourable circumstances with colonists and their women and children is absurd.

It has also been the fashion to bring forward the healthy condition of the children in the three Lawrence Asylums in the hills. It is asserted that boys and girls in these schools enjoy an amount of health and vigour equal to that of persons brought up in temperate zones. "The robust appearance of the inmates of the Lawrence Asylums, the muscular development they undergo in the cool climate of the hills, all tend to show that the mountain ranges of India are suitable to the rearing of European children, and that all necessary conditions for the maintenance of physical vigour in the race exist in these localities." But here again, the circumstances of these children are entirely different to the conditions of a colonist's life. "Boarded floors, warm covering for the feet, seclusion of the children in inclement weather, attention to ventilation and diet, improvement of intellectual status, and prompt medical care," are not always available for the children of colonists; whereas in the Lawrence Asylums such advantages are but a portion of those enjoyed. Neither have we any trustworthy statistics regarding the future of those children who have left these schools to enter upon life. Lost in the "wide, wide world," their career is generally unknown. Even the reports of the *Sunawar* establishment—the oldest of all—do not

afford any information regarding the after-life, and physical and mental energies, of its former pupils.

An attentive consideration of the question of colonization of the Indian hill ranges induces the conviction that attempts of the kind would terminate in failure. It is, indeed, quite possible that, with constant infusion of new blood and with unremitting fostering care from the State, the race might be *maintained*. But the experiment would not be either a sanitary or a pecuniary success. And such collections of Europeans, supported by the State, are not colonization, in the sense in which North America, Canada, and Australia have been colonized. Yet anything short of colonization, in the full sense of the term, would scarcely meet our requirements in India. It may, therefore, be admitted that the Indian Government has exercised a sound discretion in not obeying the periodical agitation for an expensive, and, to be feared, fruitless experiment.

Similarly, the attempt to form colonies of East-Indians as proposed by some authors, is not advisable. Although amongst this class there are many meritorious, and not a few possessing more than common intellectual and physical energy and strength, yet the reverse too often obtains to permit the expectation that the race, as a class, would prove successful colonists. The worst points of both the European and native character are not unfrequently combined in the hybrid—a condition, not only prevailing in this section of society in India, but also noted in other parts of the world; as in North America, for instance, where Europeans have sexually mingled with the coloured races. Before leaving the subject, however, we may record our belief that colonization of the Indian plains by Africans would prove a decided success. And apparently, as many may be obtained as would be required for the purpose. It was only lately that advertisements appeared in the Bombay papers, stating that Africans, captured in Arab slave dhows, were to be had for the asking, provided any gentleman became responsible for them, and would entertain them as free domestic servants. During the mutinies, the proposal to enlist African regiments was much debated. And African colonization is worth attention now.

In the foregoing pages we have indicated the progress which sanitary reform has made in India, mainly in connection with the European and native army. What has already been said is probably sufficient to demonstrate the active interest which the Government has lately taken in the important question of

sanitation ; but there still remain many topics, more particularly affecting the civil population, in regard to which the action of Government is worthy of note. These topics we hope to be able to discuss in the next number of this *Review*.

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A REVIEW OF THE PROGRESS OF SANITATION IN INDIA.

No. II.

IN continuing our review of the progress of sanitation in India, we proceed to notice the subject of forest conservancy, a subject which has attracted considerable attention during the past decade in consequence of its supposed connection with the health of the people and for other causes.

Late in 1859, the Government of India directed the attention of the Lieutenant-Governor of the North-Western Provinces to the expediency of maintaining a supply of fuel, both for railway and general consumption, by planting. Dr. Oldham then stated the geological character of the country to be such as to hold out no prospect whatever of the discovery of coal within a reasonable distance of the great marts and towns of the North-West. After a lengthy correspondence it was decided,* that the necessity was not such as to justify the expense of making plantations along the course of the East Indian Railway, inasmuch as before the trees could grow up, coal would probably come into general use; so the matter dropped for the time. Since that period, however, under the auspices of succeeding authorities, various plantations have been formed in the North-West, of which the benefit will be reaped at some future period.

In 1863, Mr. Fisher addressed the Madras Government on the advisability of encouraging the growth of firewood on waste lands, representing the extensive devastations which had taken place, especially in the neighbourhood of hill-stations, and recommending the importation of the quick-growing Australian *Acacia* tree.

* Supplement to the *Calcutta Gazette* for 1860, p. 111.

In 1864, Dr. Anderson, remarking on the systematic destruction of forests near Darjeeling, stated that it had commenced with the introduction of various forms of agriculture. He asserts that there is not a single tea plantation in British Sikkim, on which the trees have not been completely felled. "They have ignored the fact, that for every pound of tea produced, one pound of firewood and two of charcoal would be required in the manufacture." They also must have lost sight of the well-known value of belts of forest as a means of protection from winds and storms of hail, so violent in those hills, of the effect thorough clearance exerts on the climate, and especially of the fact that water-courses dry up when exposed to a powerful sun through a long portion of their course. Dr. Anderson also states, that although there are no reliable records, the general belief obtains that the summers are now drier, the winter cold more severe, and that less rain falls, than formerly. It is also pointed out that wherever forests are felled, a class of weeds previously unknown invariably spring up so luxuriously, that no seedlings of the original trees can contend against them. Hence, when forest has been destroyed, it can never be replaced, unless man interferes to protect the seedling trees.

In consequence of these and various similar reports, a forest conservancy system has been established almost universally throughout British India. In 1865, a bill for the protection of forests was introduced into Council, and rules have since been framed for the conservancy of forests in Burmah, in the Central Provinces, in Coorg, in Sikkim, in Berar, in the Panjab, and elsewhere. In the Central Provinces, during Sir R. Temple's régime, free grants of land were offered, on the condition that the occupier planted 100 trees for every 10 acres. In a memorandum, dated 1866, on the first report of the Panjab Forest Conservancy Department, the Lieutenant-Governor remarks,—“The facts stated show, in His Honor's opinion, very decisively, how urgently the formation of this department was required to introduce correct principles of conservancy and cutting, and to preserve the forests of the Himalayas from the ruinous waste to which they have been subject.” And the same remarks would be equally applicable to any other part of India.

In addition to the forest conservancy of districts thus instituted, we find Government prepared in 1866 to sanction estimates for the planting of trees along roads in or near stations, as well as in clumps at halting places along main routes of traffic. *

* *Public Works Code*, chap. ix, sec. 13.

But in 1865, we find Mr. MacIvor * combating the generally received views, that the felling of forests (on the Nilgherries) causes any deterioration of climate, or has any effect on the fertility of the surrounding (Coimbatore) districts. He commences by remarking that the South-West monsoon rainfall is dependent on the temperature and elevation of the Nilgherries. The mountains generate, and are covered by, a cold stratum of air, which condenses the moisture contained in the warm atmosphere in its passage from the sea. Hence the lower the hills, the warmer the temperature and the less condensation and rain ; and *vice versa*. Trees, however, he admits, increase the cold stratum of air, by offering a larger evaporating surface, and in this way aid in more effectually relieving the clouds of their moisture. But Mr. MacIvor argues that the more rain abstracted from the clouds in their passage over the mountains, the less there must be in the districts over which they next pass. He also remarks that trees evaporate from every leaf, to an extent more than 80 times the amount of the surface of ground they cover, and thus expend the moisture they are supposed to retain. They draw the water from the streams, which, thus intercepted, is dissipated never to return, instead of flowing on to fertilize the lowlands. It is asserted that convincing proofs may be met with in the Nilgherries, that streams arising in and flowing through valleys destitute of trees, maintain their flow better than those passing through wooded valleys. Therefore Mr. MacIvor concludes that if the Nilgherries were quite destitute of trees, the streams would carry to the low country a flow of water twice as great as they do at present !

It may be admitted that the chief cause of rain on mountain ranges is the condensation produced by the warm moist air coming in contact with the colder hills, and by the decrease of density consequent on elevation. Under such circumstances, whether the mountain slopes are bare or clothed with forest, rain would fall, neither condition having any appreciable influence on the precipitation. But even allowing this much, it is easily demonstrated that where no forests exist, the earth becomes parched and dry and eventually unfit for cultivation ; and this especially in hilly regions. Tropical forest in such positions may indeed be

* Report on Cinchona cultivation for 1863-64. Mr. MacIvor's remarks may be regarded as an extraordinary example of special pleading. They are generally supposed to be an answer to complaints that the destruction of forest consequent on Cinchona planting influenced the rainfall.

considered the *alma mater* of springs and streams. As the rain descends on natural forest, it is conveyed in various directions by the leaves, and on reaching the ground is prevented from running rapidly off by underwood, herbaceous plants, and dead leaves. It thus gradually percolates, aided in movement by the roots, to the subsoil, and eventually becomes the subterranean supply of springs.

The gravitation downwards on the hill sides is also retarded by the interlacement of root fibres, and shade again modifies evaporation; all tending to the retention of the water in the earth. But in the absence of forests on the hill sides, although the average rainfall may occur, the water rushes off immediately. No impediments to its downward course existing, it soon finds its way to the plains, and in many localities is totally lost in the neighbouring sea. Thus springs and rivers, formerly perennial, will, on the gradual destruction of forest on the hills from which they flow, only retain water for a short period after the monsoon; and the districts through which they run will suffer from drought. No water being in the streams, percolation into wells is less copious, until eventually, in numerous instances, the supply ceases altogether. It is this gradual process, which has in various parts of the world reduced the fertility of the land, and converted smiling fields into comparatively barren wastes. Moreover the presence of trees is attended by other results, which cannot be without their effects on climate. The temperature of the air in forests, and in clearing, differs as much as two degrees; hence the absence of trees must favour heat. The evaporation constantly going on from the leaves must tend to maintain the air moist, while the shade afforded and the attraction exerted on moisture by the roots must prevent dryness of the earth. Lastly, the absence of trees, probably influences the composition of the air, if, as is generally believed, the leaves not only give off oxygen, but also absorb and destroy noxious gasses or malaria.

Further, as the *experimentum crucis*, we have in various parts of the world, lamentable instances of the evil results following the destruction of forests. Thus M. Huc tells us that towards the middle of the 17th century, the Chinese entering Western Tartary found the Mongols tending their herds in forest steppes. The new comers commenced grubbing up the trees to make room for their cultivation, and

under their system of forest destruction, the country gradually became the arid region subject to periodical droughts which it now is.

And we have a similar result occurring in Western India. The great district comprising Western Rajputana, Bhawalpur and portions of the Panjab, presents traces of a population, and of ruined towns and villages, now unknown. Away in the desert, even in Marwar—'the Land of Death'—may still be seen decaying cities, demonstrating that at some remote period of Hindu history the country was comparatively densely populated, and must have been cultivated to a greater extent than now. There is indeed every reason to believe that the desert-like appearance of this part of India is due to the gradual destruction of the forest which at one period covered the face of the land. The daily consumption throughout ages of tons of fire-wood has at length effectually denuded the country of vegetation. And a result of this is that the rainfall has diminished, and the lighter alluvial portions of soil have been blown away, and not being replaced by decaying vegetation, the heavy sandy particles only remain, constituting the extending desert of to-day. When we recollect that the population of India is many millions, and that each individual requires at least one pound of fuel *per diem* for cooking purposes, the consumption of wood in this manner alone will be appreciated. Even if we make allowance for the common use of *dung* as fuel, the consumption of fire-wood must nevertheless be enormous.

In Coorg also, the effects of forest destruction have been brought to the notice of the Supreme Government by Mr. Bowring and Dr. Bidie.* Did space admit, accounts from numerous localities—as Palestine, Mauritius, Ceylon, America—might be quoted, evidencing the diminution of rainfall following the destruction of forests.

It is impossible to note all the places at which the rainfall is now registered in India. We shall content ourselves with drawing attention to the result of such registration in the Mahableswar ranges—a result which illustrates the enormous difference of the rainfall in closely neighbouring localities in India. The Western Ghâts take a south-easterly direction, are all trap, with the flanks very jungly. At one station, 14 miles from the edge of the ghâts, the fall was 51 inches ;

* *Gazette of India*, Supplement, 1868.

23 miles away, only 11 inches. At other stations, from 190 inches to 21 inches, within a range of 20 miles. At the third line of stations, 60 inches to 55 inches, the intervening distance being 21 miles. At a fourth station, Malcolm Path, 252 inches fell; 11 miles away, 207 inches; 15 miles more inland, 170; 6 miles more, only 74 inches. In all the lines of stations it was found that the fall rapidly decreased in proportion to the distance from the summit of the ghâts; but that local formations influenced the fall also. Dr. Cook, who collated the returns, further remarks that from the rain register kept at Mahableswar for the last 30 years a very remarkable phenomenon becomes apparent. This is an alternate excess and deficit every five years,—an item of knowledge which may be of moment, in connection with irrigation schemes from the rivers *Krishna*, *Yenna*, and *Quina*, rising in these hills.

In compliance with Circular No. 1076 of 1863, from the P. I. G., Medical Department, Bombay, ozone registrations, kept at various civil and military hospitals, were forwarded to Dr. Cook, then Superintendent of Mahableswar, for compilation and report. From the registrations at fifteen different stations, conclusions were drawn regarding, 1st,—The general presence or absence of ozone at each station during the year; 2ndly,—The connection between the meteorological and geographical conditions registered, and the evolution of ozone; 3rdly,—The presence or absence of ozone in connection with the prevalence of cholera, diarrhœa, dysentery and fevers. Referring to the first question, it was found that the mean daily average of ozone was from 7·5 at Tanna to 1·1 at Rajkot. But the registrations cannot be regarded as trustworthy records of the amount of ozone prevailing in the atmosphere generally, some of them being conducted in hospitals and cities, where ozone is always found to be deficient. Moreover, a single annual return cannot be considered conclusive of the character of any particular place, with regard to the amount of ozone. On the second point, Dr. Cook states that the greater prevalence of ozone was very marked during south or south-westerly winds, and *vice versâ*. Therefore ozone must be present in greater quantities in the rainy season. But very excessive moisture, again, appears to arrest its development. At Mahableswar, where 250 inches of rain fell in four months, ozone is at the lowest development during such months. The force of the

winds also affect the ozone registrations, more being present in proportion to the velocity with which the wind travels. As regards geographical position, the seashore and elevated localities enjoy the largest amount. On the third head—the development of ozone in connection with the prevalence of certain diseases—Dr. Cook arrives at the conclusion that, although it does not always follow as a logical sequence that cholera ensues as an epidemic on the absence of ozone, yet there is a decided connection between the absence or marked decrease of ozone and the presence of cholera. With regard to the prevalence of other diseases, the connection is not so marked. But the only practical deduction drawn from the above, is contained in Dr. Cook's 49th para., which runs as follows :—

“ In the third section of the report of the Bengal Cholera Commission, it is laid down that on the outbreak of cholera in an epidemic form at any station, the troops are to be immediately removed to camps formed for the purpose, at some distance from cantonments. If the cases are simply sporadic, they are not to be so removed. The decision of this frequently weighty and difficult question rests with the principal medical officer on the spot. I cannot but think that under circumstances like these, a knowledge of the condition of the atmosphere, as regards the excess or deficiency of ozone, would prove of very great assistance to him in forming his diagnosis. When ozone is shown to be deficient from the atmosphere, the fact would justifiably warrant a greater amount of precaution being taken, and a stricter application of the rules of sanitary science being enforced.”

The above somewhat meagre conclusions, regarding the influence and action of ozone, are in strange contrast to the enthusiastic predictions following the discovery and first registrations of this agent. Schönbein, while making experiments on the decomposition of water by electricity, first discovered ozone in 1839. Scoutellen of Metz published a treatise on the subject in 1856, after which Dr. Moffat and others took up the subject in England. “Ozone,” wrote Schönbein, * “is the most powerful oxidizing agent we yet know of. It destroys instantaneously sulphuretted, seleniuretted, phosphoretted, ioduretted, arsiniuretted, and stibiuretted hydrogen.” He further stated ozone

* *Med. Chir. Trans.*, vol. xxxiv, p. 205.

to be one of the chemical antipodes and antidotes to all oxidable, miasmatic, and malarious gases and emanations. Moffat and Scoutellen* joined Schönbein in the declaration that ozone is indispensably necessary to the due accomplishment of all the vital functions, and to the relief and modification of disorder and disease. Dr. Pickford† remarks,—“In confined places “where ozone cannot penetrate, plants and men become “blanched, the skin grows pallid, the blood loses colour, lymph “predominates, all the tissues soften, and serious disease of “the adynamic type breaks forth.” Pneumonia, bronchitis, influenza, and other maladies particularly affecting the respiratory passages, have been attributed to excess or diminution of ozone. The agent has also been supposed to exert destructive influence over malaria, and hence on malarious disease. A recent writer,‡ after stating that swamps and marshes near the sea are nearly always free from malaria (an assertion entirely opposed to experience§) explains this presumed exemption by the presence of ozone formed on the ocean in greater quantities. M. Kosman of Strasburg, and Dr. Ireland in India, pursuing Hirsch’s hint that trees exhale both oxygen and ozone, declared broad-leaved trees to be the most useful in this respect; and the planting of trees on the esplanade in Bombay for the special object of generating ozone was definitely proposed.|| Dr. Cook¶ believes that under peculiar circumstances ozone is capable of being concentrated in the atmosphere, and in this form becomes the active agent of the terrible simoom of the deserts of Arabia and Africa.

But even when the influence of ozone was most credited, sceptics were not wanting. Some chemists** have even doubted whether any proof has yet been given of the existence of ozone in the atmosphere. *Nitrous acid*, frequently present, will colour the iodide of potassium of the ozone paper in the same manner as ozone itself.†† Moreover, other observers have declared that the substance giving the ozone reaction, is not

* Pickford on Hygiene, p. 69.

† Pickford Op. Cit.

‡ *Madras Medical Journal*, vol. x.

§ An inquiry into the truth of opinions regarding malaria, by Dr. Moore. *Indian Annals Med. Sci.*, vol. xx.

|| *Times of India*, June 22, 1863.

¶ Report on the registration of Ozone. *Gazette of India*, p. 261.

** Frankland and Cloez quoted by Parkes, *Practical Hygiene*.

†† Cloez, quoted by Parkes, *Practical Hygiene*.

deficient in marshy districts, and that when ozone is conducted through marsh dew, organic matter is not destroyed. Burdel* found as much ozone in the air over marshes as in any other place. Parkes† does not see any evidence of weight proving that deficiency in ozone has assisted the spread of epidemics, or that excess has checked them. And most unbiased minds, after attentively noting what has been recorded on the subject, must arrive at a similar conclusion. The registration of ozone and its connection with disease, however, deserves more general attention than has been yet accorded to the subject.

The value and importance of irrigation in India cannot be better illustrated than by recent returns made by the Irrigation Department of the North-West Provinces. The increase of cultivation for the year 1868-69 in the canal districts of Hindustan, must have tended very greatly to supply the loss of grain caused during that season by want of rain. The area irrigated was just 89 per cent larger than that of the preceding year, and 95 per cent more than the extent of land irrigated during the famine of 1861. Throughout the districts irrigated by the North-West canals, the rainfall of 1868-69 averaged from one-half to one-third less than the usual quantity, but the increase of cultivation was nearly double. As the Lieutenant-Governor justly observed, "it would be hardly possible to overrate the blessings conferred on these provinces by the irrigation of over a million and four hundred thousand acres, the greater part of which would otherwise have failed to produce any harvest."

But unfortunately there is seldom unmixed good from the most laudable of human operations. And it is found that irrigation, as now practised, is attended with special drawbacks. Ten years since an epidemic of fatal fever ravaged various parts of the Allyghur district, on which Dr. Farquhar reported that he found the malady prevailing more especially along the banks of nullahs used as escapement channels for the surplus waters of the Ganges Canal. Taking a cross direction, Dr. Farquhar found that at a distance of four or five miles evidence of malarious disease began to be apparent in the enlarged spleens of the population, while, as he approached nearer the focus, the

* Burdel, *Recherches sur des fièvres.*

† Parkes, *Practical Hygiene*, p. 110.

malady became intensified to such an extent as to cause death in a few hours. And this frequently recurring malarious condition of the ground appears to be intimately connected with the formation on the surface of that peculiar efflorescence denominated *reh*. Many parts of the country, especially in the immediate neighbourhood of irrigation canals and tanks, are covered with this substance, which, it must be recollected, is entirely different to the incrustations of saltpetre so often also met with. *Reh*, according to analysis conducted in England, is found to contain about 23 parts of soda, with seventeen of sulphuric acid, in alliance with smaller proportions of potash, lime, magnesia, carbonic acid, and silica. The substance is frequently used for washing purposes, and is found useful in the removal of grease stains, ink spots, &c. It is also employed in the manufacture of an inferior kind of soap. But these uses do not at all compensate for the destructive qualities of *reh*. Wherever it appears, seeds imperfectly germinate or decay in the ground. Even grass will not grow where *reh* forms, land which for years has been highly cultivated becoming perfectly barren and unproductive, and, as is the case with all ground so deteriorated, highly malarious and unhealthy.

It is now some years since attention was forced to the subject, and still the origin and prevention of *reh* remain unsolved problems. The late Colonel Baird Smith was of opinion that the evil was caused by the canals being higher than the surrounding country. The water percolating through the soil to seek its own level, was supposed to carry with it various salts from the soil, which deposited themselves on the surface of the ground with the evaporation of the water. On the other hand, *reh* was said to exist in the water and not in the soil, and in some instances, as in the Ravce water, this has been found to be the case. But the weight of evidence points to the land as the seat of origin of these *reh* salts, which, in addition to their injurious effect on the public health, cause annually a considerable loss to the revenue of many thousands of rupees, from rendering the ground unproductive.

Another evil attending irrigation, and also closely allied to the deposition of *reh*, is the saturation of the country with water, and the consequent raising of all the spring levels. By constant irrigation from rivers, and the consequent cessation of draught from wells, the soil below the surface becomes saturated. As demonstrating the increased moisture of the soil, it is

stated, that in the Mozuffurnggur district certain land which before the construction of the canals grew wheat, now only grows rice, and former rice lands now produce bulrushes. And any tract of country in such a condition cannot but prove malarious. As a consequence of this prevailing state of saturated ground, we are told by Dr. Cutcliff that in addition to various forms of fever, a physical degeneration of a most important nature is going on among the inhabitants. It is a matter of general complaint in certain irrigated parts of the Doab and Meerut division, that the number of births is decreasing, and, as has occurred in other parts of the world under malarious influences, the race must die out and the country become a jungle, unless some alteration be practicable. The people, it is stated, are everywhere impressed with the idea that their unnatural condition has been brought on by the effect of the canals, "which spoiled their drinking water by the deposit of *reh* in the wells, impaired their appetite and digestion, and "destroyed their virility."

Now if it be a fact that the extension of irrigation is thus attended with evils such as we have described—with fatal malarious fevers, or the less rapid but not less certain degeneration alluded to—the impracticability of thus 'developing the country' must be sooner or later admitted. Even irrigation schemes must give way to the all-powerful influences of malaria. But it has not yet been fully proved that the increase of malaria must result from irrigation. It is the *abuse* and not the *use* of water from which *reh* and malaria arise. It is over-irrigation and the absence of drainage which produce the evil. The useless deluging of acres of land with more water than is requisite for the growth of the crops, may certainly be authoritatively stopped. But the combination of irrigation and drainage is a more difficult matter. It is an important problem which engineers are called upon to solve. And if no other remedy is possible, except by deepening the canals, so that the water must be raised to flow over the adjoining country and may drain back, such a method must be pursued, instead of carrying the water above the surrounding land; and this, whatever may be the attendant expense. Otherwise, malaria will not leave any people to use the canals.

Very few subjects have received more attentive sanitary legislation than emigration; and this particularly during the

past decennial period. In 1860, we find the emigration of native labourers authorized to Natal, to St. Kitts and to certain French colonies, and emigrant ships were required to be supplied with Normandy's water distilling apparatus, so that five gallons per week for each person might be ensured. In 1861, emigration was extended from Mauritius to the colonial dependency of Seychelles. In 1862, the bill providing for emigration to the French colonies was amended, provision being made for the suspension of the Act, should at any time proper measures not be taken for the protection of the emigrants at their destination. In 1861-62, no less than 31 emigrant ships left Calcutta and Madras, conveying away 19,880 emigrants, with a mortality of 8.54 per cent. It was found that in ships carrying neither Normandy's apparatus nor surgeons, the death ratio from 1855 to 1862 reached 7.07 per cent; in ships carrying the distilling apparatus 5.60, and in vessels provided with both apparatus and medical aid only 3.36 per cent. In 1863, an Act repealing all others was passed, and contracts for labour were rendered unlawful, except to British colonies and French possessions. Emigration agents, a Protector and a Medical Inspector of Emigrants were appointed, remunerated by fixed salaries; depôts were established, licenses issued to emigrant ships, scales of provisioning laid down, rules regarding space issued, and measures adopted for surveying vessels before a voyage. The good effect of these regulations was exemplified in the report of the voyage of the *Alnwick Castle* to Trinidad, resulting in the alteration of one regulation, by which the length of time emigrants are kept on deck is now decided by the medical officer in charge. In 1863, a bill was also passed, authorizing emigration to the Danish Colony of St. Croix, and regulations were laid down regarding the transport of native labourers to Assam, Cachar and Sylhet. In 1864, emigration was permitted to Queensland. In 1865, rules relating to emigrants from the Port of Calcutta were issued by the Governor-General, under section 63 of the Emigration Act. This code is very full, and provides for every sanitary requirement, both on the voyage and while in depôt, to the most minute detail. Similar rules were shortly afterwards applied to the Ports of Madras and Bombay. In 1867, an addition to the diet scale of four sheep for every 100 emigrants proceeding to the West Indies was ordered. In 1868, crystallized carbolic acid was substituted for all other disinfecting agents on board emigrant ships.

Although, so far as we know, no other colony to which Indian coolies are despatched is now devastated by epidemic fever, there can be no doubt that emigrants landed at many of the places mentioned in the schedule, are practically placed in a climate and under circumstances entirely foreign to all former experience, and hence, almost as a matter of course, mortality must occur among these people in an increased ratio. In 1868, the Secretary of State drew attention to the death-rate among Indian coolies in British Guiana, which on some estates exceeded 5 per cent.[†] Of St. Vincent coolies it is remarked that, although their health is good, their earnings are unavoidably small from causes chiefly physical. § And so on might be quoted from various reports on the subject. It therefore seems more than probable, that the Indian cooly does not much better his circumstances by leaving his native land. Following the example of the recruiting sergeant, when pressing the shilling on an unwilling clodpole, or emulating the conduct of American sellers of lots "down east," there can be no doubt that Indian emigration agents picture an *El Dorado* to the unfortunate victims

Ditto „ p. 694

whom they desire to entrap. No person on earth is more credulous than the native of India, when one of his own race is the deceiver. When, however, he arrives at the Mauritius, or wherever else he may be bound, he finds out the mistake he has made. So long as he is in *depôt*, at the port of embarkation, or under Indian rules and regulations on board ship, he finds his wants and even comforts studied. But once landed on the sugar planter's estate, instead of the *dolce far niente* anticipated, he finds himself under a contract to work for those who, even if not rivaling Shylock, insist on a fair day's work for a fair day's wages—a return which Indian coolies are not always anxious to render. Of course every man has a right to carry his labour to the most remunerative market, even to the uttermost ends of the earth. But it may be questioned, whether by emigrating the Indian cooly does this. It is doubtful if his condition would not be better, if he remained in India. It is true he is supposed to be a free agent, but he is *persuaded* into exerting his freedom by misrepresentations. And the increased demand for labour in India renders it at least questionable, whether encouragement to emigration should be accorded by the legislature. It was but some short time since the Madras Government addressed the Secretary of State on the desirability of introducing mechanical means to supply the *want* of labour, and also recorded the intention of introducing into all schools a system of instruction in the theory of mechanics, and of offering prizes for the invention of machines suitable to the wants of the country. And the same difficulty in procuring labour, felt in Madras, has extended to other districts, particularly in the Western Presidency. Within the last ten years, cooly hire has indeed doubled itself in most parts of the country. All departments employing native labour cry out about the difficulty of procuring a sufficiency. And the public works, now in progress or proposed, barracks, irrigation, railways, must for many years to come increase the want. But even were not this the case, there is in India plenty of space for every Indian. The idea that India is an over-populated country is not correct. Excepting perhaps the delta of the Ganges, the country is under-populated. Thousands of square miles await occupation and cultivation, a result which, if achieved, would tend towards the prevention of famines, and the attendant or subsequent disease. Without interdicting emigration, policy appears to forbid its encouragement, while on the other hand, it

would appear desirable to afford some inducement to persons willing to try their fortune in the less populated portions of Hindustan.

The conclusions and proposals of the International Sanitary Commission of Constantinople, which, as previously mentioned, are not altogether unquestionable, have nevertheless resulted in considerable action. Judging from the proceedings of the last two years, we may perhaps now fear over-legislation on the subject of quarantine. Regulations which are most useful when enforced with judgment and moderation, may be, and indeed have been, made utterly obstructive to both commerce and travel. Some years back when quarantine was more practised in the Mediterranean than at present the loss thus entailed was estimated to amount to three millions sterling. The trials which travellers have undergone, owing to a vexatious system of quarantine, have often been made the subject of complaint in the public press.

By regulations of the Turkish Government dated 1865, vessels bound to Bussorah, on arrival at the *Shat-el-Arab*, are to communicate with the sanitary officer at Fao, who will give a certificate of health to enable the vessel to pass up the 50 miles of river between the head of the Persian Gulf and the town first named. Now, being acquainted with Bussorah and the other localities mentioned, we feel perfectly sure that disease, whether plague or cholera, is much more likely to be conveyed from Turkish Arabia towards India than in the reverse direction. Vessels passing to Bussorah would proceed from Bombay, from Muscat, from Abushire, or other places in the Persian Gulf, not one of which was some years back so filthy, or so likely to become the seat of epidemic disease, as Bussorah with its date grove swamps, and foul canal leading to the *Shat-el-Arab*. In fact, the true plague did really appear in Turkish Arabia in 1867, in the Hindich district, but appears to have been stamped out by energetic sanitary measures.

Again, under regulations of the Porte, it was ordered in 1866 that vessels from India should be inspected and perform quarantine at Jeddah, if necessary, before proceeding towards Suez. And in 1867, Turkish regulations against cholera, were forwarded by the Secretary of State to India, entailing a ten days' quarantine and purification of personal possessions; the quarantine, however, becoming less after so many days at sea, until but 24

hours is required after 20 days' sail. Of course these rules only applied to vessels arriving at Turkish ports from infected places. But in the absence of a bill of health it was decided that vessels from any place should perform quarantine, although passengers might be passed by quarantine trains across the Isthmus of Suez.

In 1868, a Sanitary Commission for the Red Sea was appointed by the Turkish Government, the members of which, five in number, were to be stationed at the different ports during the Hedjaz.

As a consequence of these latter arrangements, we have reports vitally affecting the subjects of Her Majesty in British India, who perform pilgrimage to the holy places of the Red Sea. We well recollect in 1865 a Haji, who with twenty-five followers made the pilgrimage to Mecca, telling us on his return that twelve died either on ship-board or in the streets of Mecca. And this among the followers of a man, able and willing to afford them every necessary of life. But it is to be hoped that recent regulations will effectually prevent the recurrence of any such mortality. A letter from Dr. Dickson, forwarded to the Government of India in 1868, gives an account of recent sanitary improvements in that most unhealthy of cities, Mecca. Proper latrines had been constructed, the streets had been watered, the sewage conveyed away underground into receptacles half an *hour's* distance beyond the outskirts of the city, and slaughter houses removed from the town. But, it was added, "the poor people still linger in the streets, until proper shelter can be provided." At Jedda also, the sanitary conditions appear to have been greatly improved. Swamps formerly surrounding the town had been partly filled up; bazars and streets had been widened, and covered in as a protection against the sun; fresh water had been made abundant, and a lazaretto with a medical officer attached opened for the pilgrims. The Hedjaz of 1869 passed off with merely nominal deaths among the assembled pilgrims. It is not therefore too much to attribute this satisfactory result to the sanitary measures noted.

The importance of a good understanding with regard to the nomenclature of disease adopted by various nations, no less than the importance of a carefully devised quarantine system, was well demonstrated at the commencement of the year 1869. The steamer *Pearl* arrived at Jeddah from Bombay, with a health certificate mentioning that deaths from cholera had

occurred in the latter city. The *Pearl* was therefore subjected to quarantine, and alarm was excited at Constantinople by exaggerated reports of sickness at Jeddah. But the cholera mentioned in the *Pearl's* certificate referred not to *epidemic* or Asiatic cholera, but to those *sporadic* cases of the malady so often presented in all oriental, or indeed often in English, towns. It was therefore suggested that the ordinary mortality rates of Indian cities for some years past should be furnished to the Turkish authorities, from which they might judge if the number of cases reported in any vessel's certificate, as prevailing at the period of sailing, were above the average. A more clearly worded or detailed certificate would, however, appear to be the better remedy.

There is ample evidence that a limit exists beyond which sanitation cannot be neglected without the result of one form or other of epidemic disease. During the decennial period under review, various parts of India have been devastated by a peculiar typhoid malarial fever—the direct result of the circumstances under which the population affected exists. It is scarcely thirty years since the malady as above explained culminated in ‘mahamurree,’ a malady very similar to the true plague, and which, originating in Guzerat, spread under the name of ‘Pali Plague’ even to the snowy range.* It also re-appeared in the south of Rajputana in 1855, and again in Kutch in 1860. Under the influence of sanitary measures energetically enforced, the first epidemic of ‘Pali Plague’ was eventually overcome. The two last subsided spontaneously, or probably the malady relapsed into that malarial typhoid fever, perhaps less suddenly fatal and therefore less alarming than the so called plague, although scarcely less disastrous in its effects. Happily during the past ten years, with the exception of a slight re-appearance of *mahamurree* or plague among the Wagheers of Kutch in 1860, the country has been free from

* A history of the Pali Plague may be found in vol. i. *Bombay Medical and Physical Society*. Also see *Indian Annals of Medical Science*, 1854. It will be apparent from the text that we regard the malady described as Pali Plague or *mahamurree* as identical with malarial typhoid fever (not using the term typhoid as signifying intestinal fever). Pali Plague appears the more severe manifestation of the malady, as the climax arising from the neglect of sanitary principles. The descriptions recorded of *mhamurree* are not those of true plague or *pestis*, from which it differs in being frequently complicated with marked lung disease.

what may be regarded as the fully developed scourge. But, as will presently be shown, the epidemic fevers which have occurred in various districts almost forbid from their destructive results congratulation on the absence of plague. The following districts have, during the past decennial, period, been more than ordinarily subject to epidemic typhoid malarial fever;—the Allygurh Pergunnahs, reported on by Dr. Farquhar in 1859; the Hooghly, Nuddea and Baraset districts, reported upon by Dr. Elliot in 1862; North Canara, reported on by Dr. Leith in 1863; Northern Guzerat, reported on by Dr. Martin in 1865; Southern Rajputana in 1863, not made the subject of public official report: the Rohilcund division, reported upon by Drs. Stewart and Haines in 1862-63; the Meerut division by Dr. Cutcliff in 1868; and the Hooghly districts, again reported on by Dr. Smith in 1869.

Regarding the Allygurh Pergunnahs, Dr. Farquhar* stated that he found the malady prevailing along the banks of ditches used as escapements for the surplus water of the Ganges Canal. Taking a cross direction it was found that at a distance of four or five miles, evidence of disease began to be apparent in the enlarged spleens of the population, while as the focus was approached, the malady became intensified to such an extent as to cause death in a few hours. Dr. Farquhar thus described what he witnessed:—"One or two deserted villages were passed through, and several on the outskirts of the inundation were visited. These latter had suffered from fever to a comparatively small extent. Another large village further up was entirely deserted except by a dog or two, the nature of whose food could be readily imagined from the gnawed human bones, that had been dragged from a shallow tank close to the village. The living had been unable to bury or burn their dead, and had thrown them into the water to cover them from sight!"

Dr. Elliot's report † on the Hooghly districts disclosed, if possible, a still worse condition. From the investigations made by Dr. Elliot, it would appear that since 1824 epidemic fever has periodically broken out in the Jessore, Baraset and Hooghly districts. When inspected in 1863, the majority of the villages in the above districts were affected. During the previ-

* On Canal Irrigation. Read before the Punjab Agri-Horticultural Society.

† Supplement to the *Calcutta Gazette* for 1863, p. 156 *et seq.*

ous autumn, 20 per cent. of the population had died, leaving four-fifths of the remainder suffering from obstinate intermittent fever of the tertian or quartan type, from enlargement of the spleen or liver, from dysentery, diarrhœa, dyspepsia, or general anasarca. The villages are described as consisting "principally of scattered groups of huts, connected by belts of trees, and mango and bamboo topes, the whole being surrounded by a dense and impenetrable jungle. In the centre, and round each clustre of huts, excavations have been made, and from the earth thus obtained the huts have been constructed. These holes, more or less extensive, become filled with water during the rains, which is allowed to stagnate during the rest of the year. They are used promiscuously for drinking, bathing and washing, and the filthier they are, the greater the attraction to them seems to be. To those who have not actually seen it, it is almost impossible to imagine the denseness of the jungle, or the number and filthiness of the tanks; wherever the latter have been most numerous, there the most fatal effects of the epidemic have been most marked."

The causes of this Hooghly fever, were therefore reported to be as follows:—1. The bad sites of the villages, standing on the banks of stagnant rivers, or located near jheels or marshes. 2. The nature of the soil being always alluvial. 3. Want of cultivation of the land, on which every kind of vegetation grows and decays unchecked, and where various animal substances accumulate, decompose and putrefy under the action of heat and moisture. 4. Position and overcrowding of houses. 5. Excess of vegetation and bamboo cultivation in the immediate vicinity of the dwellings. 6. Bad water, and the condition of the tanks. 7. Absence of all attempts at drainage. 8. Position of Musalman graveyards and Hindu burning ghats in the immediate vicinity of houses. In the burning ghats carcasses half burnt in all stages of decay were common! 9. Bad food. 10. Scanty clothing. 11. Neglect of Conservancy. 12. The custom of sleeping on the damp ground. 13. Fear.

The measures recommended for the prevention of the disease were,—1. The removal of superabundant vegetation, and thereby the admission of light and ventilation. 2. The best tanks to be re-dug, cleaned, and others to be filled in. 3. All holes and excavations to be filled. 4. Drinking-water tanks to be separated from those used for bathing, &c. 5. Drains to be constructed and maintained clean. 6. Foul streets to be cleansed, paved and kept in

proper condition. 7. Burning ghats and burial grounds to be kept in good order. 8. Surrounding jungle to be cut down and cultivation encouraged.

These remedies were described by the Lieutenant-Governor as "simple and obvious," and with only "ordinary co-operation on the part of the zemindars and the inhabitants themselves in giving them effect," the probability of the return of the fever was regarded as remote. "It seemed to His Honor, that after the serious lessons they had now had, the mere instinct of self-preservation would, with proper and judicious aid and encouragement, compel the survivors to recognize the inevitable effects which must result, if they persisted in fostering all the conditions which have, from time to time and in all countries, been proved to be the most powerful predisposing causes of disease." The Lieutenant-Governor further stated* that he could not in common fairness expend money from the general revenues of the State in remedying the condition to which the people of a particular part of the country had reduced themselves by apathy and neglect. But he would co-operate in any organized system of sanitary relief. Accordingly the somewhat extraordinary step was taken of calling upon the British Indian Association for aid. At the same time the magistrates of the different districts were addressed, and an engineer officer, Lieutenant Hills, was deputed to the locality.

It soon became evident, however, that during the short time, which remained before the monsoon, the Augean task of cleansing the whole of the affected district would be impracticable. It was therefore determined to confine all efforts to a few of the largest and most fever-stricken villages. Matters were explained to the inhabitants; the advantages that would result from the adoption of the proposed measures were pointed out, and a subscription list to supplement the Government grant was opened. Sums varying from Rs. 200 to Rs. 3000 were promised in weekly instalments, the first of which only was paid, "after which the subscriptions ceased, and hence the impossibility of entertaining any large working establishment." It happened unfortunately that Mr. Maclean, the Magistrate who was charged with personal supervision over the works, became affected by the prevailing fever, and the fact appears to have been seized upon by the natives as an excuse for withholding their promised contributions. The indifference

* Supplement to the *Calcutta Gazette* for 1863, p. 173.

exhibited by the inhabitants was most distressing. "I have spoken to them," wrote Mr. Schaleh, "and urged the necessity of their immediately undertaking sanitary measures, but my appeal has met with no response, and I am convinced that not only shall we obtain no voluntary assistance, but that to procure the necessary labour, we must import coolies from other districts." "I very much fear," wrote Mr. Hills, "nothing will be done except by coercion, as the villagers have displayed much apathy to their own welfare, and in some cases have offered resistance to measures solely adopted for their own benefit, and in fact have done all in their power to retard the progress of the works; the richer and more influential natives having proved the most troublesome, trying by every means in their power to incite the rest of the inhabitants to refrain from adopting, or allowing the measures to be carried out." Notwithstanding this opposition, nineteen large villages were made comparatively clean, were partially drained, had their tanks cleaned, and much of the surrounding jungle removed. The reduction of sickness was very marked. According to the computation of the natives themselves, the mortality was reduced 40 per cent.

But even these spasmodic efforts at sanitation do not appear to have been continued. We have from time to time since 1863 heard of the recurrence of mortal fever in the Hooghly, Baraset and Nuddea districts, although no official record of its progress appears.

At length in 1869, the natives themselves, like the cartman calling on Jupiter, submitted a memorial to the Bengal Government. The mortuary returns of 181 villages were attached to the memorial, and it was stated that in the village of Dwarbasini, mentioned as an example, out of a population of 2,700 souls 1,900 had perished during the last five years, and that among 820 living men there were not two hundred able-bodied. The picture drawn by the natives was a sufficiently gloomy one; but the testimony of Dr. Smith, the recently appointed Sanitary Commissioner for Bengal, fully confirms the statements which the memorial contained.

Dr. Smith denies that the fever is epidemic, and regrets that the term should ever have been applied to it, as it has induced a belief that as soon as the shock has passed away, everything would return to its normal condition, whereas as an *endemic* malady it is ever present among the people. The causes of the

disease are to be found, according to Dr. Smith, in the defective state of the surface drainage, caused by the physical changes constantly occurring in an alluvial district, the gradual silting up of tanks and streams, and the filthy habits of the people themselves. Every revolting abomination now, as when Elliot reported, is to be met with in these villages, and the connection between the atmosphere thus polluted and the sickness and cachexia of the people cannot be questioned.

Although it may perhaps be doubted if neglected local sanitation is *altogether* the cause of the sickness prevailing in these districts, it is still admissible to express a hope that mere temporizing with the evil will not be allowed. Sanitary history abundantly demonstrates that without some authoritative machinery even common cleanliness will not be attended to. And this not only among the comparatively ignorant and apathetic natives of this country, but even in European communities. Knowing this to be the case, we feel sure that nothing but authoritative interference will avail to remove existing preventible causes of disease in mofussil India. Both policy and humanity forbid that authority should remain passive, while our ignorant and misguided fellow subjects are destroyed in thousands by preventible disease. The sinews of the country are thus strained and snapped, villages are depopulated, and the land becomes a desert. The fact that Indian village life has from the days of their Aryan forefathers been pretty much what it is now, is no argument in its favour. It is indeed quite the reverse. Centuries of neglected sanitation have left their indelible marks on the natives of India. It has been the fashion to attribute their peculiar attributes, the proverbial apathy, *finesse* and faithfulness of the Hindus, especially to the food they eat.* But at least as much of the peculiar *mizaj* which characterizes so many of the natives of this country, arises from the deteriorating influence of the air they breathe, and the water they drink.

We have no hesitation in asserting that no one under a civilized Government, whether native or European, whether resident in a military cantonment, a civil station or a native town or village, should be permitted to endanger the public health by inattention to the ordinary rules of sanitation. And if no legislative Act at present suffices to bring authority to bear on

* *Vide* Mill's *Political Economy*, vol. i.

both individuals and communities, we venture the opinion that executive machinery adequate to the purpose should be immediately devised, and put in operation throughout the country.

Immediately after the report on the condition of the Hooghly districts, we have in 1863 Dr. Leith's report on North Canara.* From this document it appears that since 1860 epidemic fever had assumed a more severe type, being spread over the whole zillah, except at some few places on the sea-coast. It was calculated that 27 per cent. of the population were affected. In the official resolution † on the subject, it was recorded that the information which had reached Government relative to the extensive prevalence of an epidemic fever differing from the ordinary fever of the district, had not in any respects been exaggerated; indeed, "the statements of Dr. Leith show that the evil is far more serious and difficult of cure than was first supposed." Medical aid and medicines having been furnished, the attention of local authorities was called to the remedial measures pointed out.

Amongst other defects the condition of the drinking water was particularly commented upon. Mr. Campbell, the Superintendent of Police in North Canara, thus describes the supply: "When one remembers that this tank-water washes down from the fields a great proportion of the ordure, the remains of dead animals, and every conceivable filth that accumulates in the environs of a village, and that shallow and unrenewed it remains stagnant and reeking under a tropical sun, it does not seem strange that the people who have no other drink should become ill. We visited one of these tanks; we saw the people going into the water, and before filling their vessels, washing their legs and feet in the very water they were going to drink. We took some of the water out in a tumbler, and found it of a yellow colour, and so thick that we could not see through it."

In order to render the water drinkable, Mr. Campbell recommended that each village should be supplied with filters, composed of double baskets, with a layer of charcoal between the outer and inner basket.‡ Dr. Ross, who examined the water before and after this filtration, stated that the cleansed water was pleasant to the taste, clear, and sparkling, and contained no trace

* Supplement to the *Calcutta Gazette* for 1863, p. 294.

† Dated 30th May 1863.

‡ Filters on the same principle might be more durably constructed of perforated zinc, iron or wood, or even of stone masonry.

of organic matter under the microscope. The unfiltered sample contained a large percentage of organic matter, and numerous animalculæ of the *protozoic* variety.

Yet even this simple, inexpensive and well-tested remedy does not appear to have been adopted. The Magistrate forwarded Mr. Campbell's communication, accompanied by the expression of a wish that the latter would "succeed in improving" these simple contrivances for removing the presence of the "horrible beasts," meaning the animalculæ, which, he somewhat sarcastically adds, "have been so eloquently described by "the learned civil surgeon." Mr. Campbell very properly replied that if the subject seemed worthy of attention, it was for the Collector's department to follow it up. Lastly, on the whole matter being referred to Government, Collectors and Engineers were requested to *report* what means, having regard to economy and efficiency, they would recommend for filtering tank-water.

Another simple method of obtaining comparatively pure water from tanks was recommended by the Principal Inspector-General of the Bombay Medical Department. This consisted in digging holes near the margin of tanks, into which comparatively clean water filtered. There is however no record of authoritative interference in order to carry out these requirements, although the Collector, Mr. Shaw Stewart, reported that "a good deal of land had been "thrown up in consequence of death and illness."*

In the cold season of 1863-64, the southern part of Rajputana, especially Serohee and various portions of Marwar, was afflicted with severe fever. During the two previous monsoons, more than double the ordinary amount of rain fell. On Mount Aboo 123 and 98 inches were measured, against an average of 69 inches. At Soudpoo in Marwar, where the fall rarely exceeds 12 inches, the unwonted spectacle of floods occurred, far exceeding anything of the kind "within the memory of the oldest inhabitant." During the ensuing cold weather a typhoid malarious remittent form of fever was very prevalent, from which large numbers died. The inhabitants staggered about their villages like drunken men, haggard and emaciated, more or less jaundice being a frequent complication. And the condition of the villages in these districts, with the exception of being less surrounded by jungle, is in every respect as destitute of sanitation as those in North Canara, or on the banks of the

* *Gazette of India*, April 9th, 1854.

Hooghly. At many places tank-water only is procurable, and this often brackish. Women not only fill their *gharas* from the same water they wash in, but also from the same water the cattle drink from and bathe in, and often within a few yards of a micturating buffalo !

In 1864* a report was published regarding epidemic fever in Rohilkund. Dr. Stewart described this malady as similar in its nature to the continued fevers of Europe, with a crisis on the eighth day, a strong tendency to head affections, and death by debility as in typhus, the only *post-mortem* appearances being congestion of the brain. Dr. Haines described the malady as a low remittent, with tendency to complication with liver affection, as exhibited by the jaundiced tint which most of the cures assumed after the lapse of a few days. Dr. Corbyn stated his opinion, that the fever, at first endemic, afterwards became infectious. Here also the general want of sanitation, the impurity of the drinking water, and the filthy habits of the people are commented upon, and referred to as the exciting causes of the epidemic.

In 1865 the outbreak of a malady said to resemble the Pali Plague was reported in the northern districts of Guzerat, and in the independent principalities of Palunpur and Radunpur. Dr. Martine, of the Bombay Service, who was despatched to investigate this disease, reported the malady not to be plague, but a severe form of typhoid malarious fever.

Early in 1868, owing to the prevalence of fever in the Meerut Division, Dr. Cutcliff was deputed to investigate the subject. The burden of Dr. Cutcliff's song was the old tale,—defective sanitation, want of efficient drainage, and filth everywhere. The most important portion of Dr. Cutcliff's report, relating to the peculiar physical degeneration of the people, has been already noticed in our remarks upon irrigation.

At the close of 1863 the Government of Bombay directed the attention in administrative officers in the civil department to the sanitary improvement of cities and towns ; and the reports thus elicited were placed at the disposal of the Sanitary Commission on the first establishment of that body. It then became apparent that the existing law rather impeded that expedited the progress of sanitary reform. One great hindrance was stated to be the want of jurisdiction by the subordinate

* *North-Western Provinces' Gazette*, August 9th, 1864.

magistrates in cases of nuisance. The chief authority of the Kandeish district mentioned that in 1862 one of the *mamlutdars* committed for approval 181 persons fined for offences punishable under Section 19 of Regulation XII of 1857. But in the following year the same *mamlutdar* committed only six cases, feeling that in the generality of instances it was a hardship both to witnesses and accused to send them to the Collector's camp, which might be often 100 miles distant. Evils, it is said, obvious even to a native eye, were allowed to remain unnoticed, when punishment could not be inflicted without a journey for all parties to a distance of perhaps 50 or 60 or 80 miles. It was therefore suggested that further powers should be given to subordinate magistrates of towns and villages.

In 1869* the Government of the North-Western Provinces issued sanitary regulations drawn up for the benefit of the people by the Sanitary Commissioner, Dr. Planck. In simple language the object in view is stated to be the improvement of the air and water which the public breathe and drink, to be accomplished by the removal and burial of impurities, by filling in holes, by maintaining the cleanliness of streets and keeping them paved, by the removal of manure heaps, by avoiding overcrowding, by thinning and planting trees on certain principles, by keeping the best well for drinking purposes, and by protecting it by a parapet, and by keeping the ground round the wells especially pure and clean.

Although in this sketch of the epidemic fever which has prevailed in various parts of India during the past ten years the urgent necessity of enforcing sanitary regulations has been dwelt upon, we are altogether of opinion that something more is required than the term 'sanitary regulations' generally implies. Although epidemics of fever have occurred in localities like Rajputana, Guzerat, North Canara, where such works as railway embankments, irrigation canals, and raised metalled roads are unknown, still it is none the less a fact, that fever has been more persistent and destructive in all those localities to which we are accustomed to point as presenting triumphs of European administration. However humiliating this reflection may be, the fact is undoubted, and to ignore it is to perpetuate the evil. If we ignore it, the natives certainly do not. They ask

* Supplement to the *Gazette of India* for 1869, p. 122.

if the boasted improvements of the English have not resulted in physical, if not moral, deterioration of the people in those localities where the most magnificent works exist. They assert that the raised metalled roads, the railway embankments passing for hundreds of miles through a flat country, have interfered with the natural drainage; that the canals have saturated the subsoil and produced an atmosphere damp, malarious and unhealthy. They complain that we have assigned too much importance to jungle, to rank vegetation, and want of conservancy in their towns and villages, and, lastly, they adduce the argument that the few sanitary regulations enforced have not been followed by any certain and favourable result.

But the truth—the cause of the fever—is neither altogether due to the neglect of sanitation nor to the operation of our public works, but to *both*; and in certain localities to other influences over which we have even less control. The fever prevailing may be best described as of a mixed type—*typho-malarial*, and it appears probable that the typhoid condition is dependent on the want of sanitation generally apparent, the basis of the fever (if we may use such an expression) being malarious. There has indeed been much contradictory opinion expressed with regard to the exact nature of Indian mofussil fever, and with good reason. For according as malarious influences or typhoid influences mostly prevailed, so the type of fever assumed more nearly true malarious, or true typhoid, conditions. It is indeed probable that both varieties of fever really co-exist, marking and confounding characteristic symptoms. We cannot indeed altogether attribute Indian mofussil fever either to defective sanitation or to the influence of public works on the drainage of the country. Both conditions produce their peculiar fever, and these, combined or co-existent, decimate the inhabitants.

But, as before remarked, there is still in some localities another cause over which we have even less control, and this is the silting up of rivers in the delta of the Ganges and other places. It is authoritatively stated* that the deposits brought down by the Ganges and its tributaries on their way towards the sea, are gradually filling up large low-lying tracts of country and river channels, which must remain for a considerable time

* Letter to the Secretary of State by Deputy-Inspector-General Sutherland, June 1869.

in the condition of a malaria-producing swamp. The causes producing such results have doubtless been in operation for an indefinite period, but it is only latterly that their continuous action has resulted in that climax capable of exciting endemic disease. As the rivers silt up, the annual inundations of the rainy season extend. The river bed becoming more and more shallow, the area over which the flood water spreads must be greater, and therefore more water stagnates on the surface of the country.

Dr. Sutherland, Deputy Inspector-General of Hospitals in Bengal, has recently addressed a most able letter to the Secretary of State, in which the influence of this natural silting of rivers, and the action of raised road and railway embankments as impeding drainage, are credited with the whole onus of inducing Indian mofussil fever. While not agreeing in the opinion that this Indian fever is altogether malarious, we are convinced that in many localities malaria plays the most important part. As in other places, deficient sanitation is the chief agent, and for this reason Dr. Sutherland's recommendations seem to demand immediate attention. Wherever roads have been carried through a district, great care should be taken to find if they have not acted as artificial drains, and held back water seeking a lower level: culverts should be constructed in all such cases. Along the line of railway, it cannot be doubted that a greater number of such passages for the free flow of water is urgently required; the destruction of railway bridges in Bengal prove that this matter was not sufficiently attended to. "In estimating the effect of obstructed drainage in causing endemic fever in Lower Bengal, it should be recollected that the whole district is formed of sedimentary deposit; everywhere in the delta of the Ganges the superficial surface soil (generally about 10 feet in depth) over-lies a bed of clay which is nearly impermeable to water." Dr. McClelland, in his *Topography of Bengal* states that "without the surface soil Lower Bengal would be a swamp, without the underlying clay it would be a desert."

But Dr. Sutherland confesses that even if railway embankments and raised roads are effectually prevented from becoming impediments to natural drainage, there must still remain much swampy and ill-drained land. In order to avoid this evil, the novel proposal is made, that tanks should be dug in all swampy, damp localities. This is in direct opposition to the recommen-

dations of Dr. Elliot in 1860, who advised the filling in of many existing tanks. But the fact is, tanks and ponds, like many other things, have both their use and abuse. If permitted to remain in a filthy condition, and if used for all purposes, washing, drinking, watering cattle, if sewage finds its way into them, if they become overgrown with aquatic vegetation, if the surrounding surface degenerates into swamp, there is no doubt that tanks must prove injurious. But collections of ordinarily clean water are not deleterious, and there is evidence to show that even a stagnant lake may be maintained pure and sweet by a suitable proportion of animal and vegetable life in the water. And if thus maintained sweet by preventing pollution and by aquatic herbs and fish, tanks must prove beneficial. The country for some distance round is drained into the tank, and therefore the saturated state of the surface soil is relieved. If it be objected that digging tanks in marshy land is too expensive for general adoption, it may be remarked that the value of the land so reclaimed would in many localities, especially near large towns, be so enhanced as to pay a considerable portion of the cost. It is stated that various places, such as Burdwan and Kishnagur, have become more healthy, since tanks were excavated in the neighbourhood.

The Government of India propose a very much more extended system of railway communication, as well as an indefinite increase of irrigation works. But unless sanitary principles as well as profit are consulted in the triumphs of civilization proposed, both railways and irrigation canals, especially the last, may prove 'perilous gifts.' By rendering the country artificially malarious, we condemn the inhabitants to early death, and render their progeny weak, feeble and incapable;—conditions which the neglect of sanitation alone would certainly not render *permanent*, although disease would as surely be produced therefrom. Such injury can only be avoided by preventing the artificial draining of water by road and railway embankments, and in irrigated districts by preventing the subsoil from being permanently saturated with water. The first requisite is simply a question of money, the building of a sufficient number of culverts. The problem of effecting canal irrigation without undue saturation of the soil is, as mentioned in our remarks on irrigation, a problem for the engineers to solve. As now carried on, irrigation involves a canal of water above the level of the surrounding surface, the deleterious effect of which has already been noticed.

It also involves the waste of water, and the stagnation of such waste on the surface of the ground. We require a system of irrigation, which will afford sufficient water and no more than is required to grow the crops. Every gallon in excess is deleterious to health, yet we frequently hear of waste of water by the natives, of fields unnecessarily deluged. There certainly should be no insurmountable difficulty in combining sufficient irrigation with sufficient drainage. Unless some means of doing so be devised, irrigation will eventually prove a curse rather than a blessing. It will certainly prevent the people from suffering from famine,—not by giving them abundance of grain, but by killing them off by disease.

We may be mistaken in the idea, but it appears to us that sufficient importance is not attached to the necessity of good drainage, either by the civil authorities or by the engineering department. The latter look only to the appearance and stability of their work, and ignore swampy spots as a cause of disease, which to the sanitary mind suggest malarious maladies, from the marked intermittent to the rapid remittent, from the general malaise to the most advanced cachexia. But we may preach of the etiology of disease without the desired result, until the time comes when we are no more heard, unless one somewhat unlikely occurrence takes place; and that is a course of instruction in the causes of disease and sanitation generally, in all the schools and colleges in the land.

Few matters of recent legislation have effected more towards the improvement of the public health in the large towns of India than the institution of Municipal Commissions, including in the term Sanitary Boards. Without referring to the utility of these bodies in laying the foundation in this country of self-government, they are immediately and especially beneficial in improving the sanitary condition of the localities in which they exist. Of course such institutions do not progress without opposition, misrepresentation, cavil, and internal quarrel. either, perhaps, is it well they should do so. An 'opposition' is the safeguard of all gubernatorial or public bodies, and the remarks, reflections and strictures, one sees in the public prints on municipal commissions are, if not particularly, at least generally, the best signs of progress. During the ten years under review, commencing with the presidency cities, municipalities have been instituted in most of the important

towns of British India where a mixed population of Europeans and natives reside. Many of these commissions commenced as Sanitary Boards, afterwards expanding into municipalities. The latter, however, cannot yet be regarded as generally 'free and enlightened,' although in time they will doubtless become so. Government still reserves the right of appointing certain officers *ex officio* as Presidents or Members. This, however, can only obtain for a time, and the more interest native gentlemen show in the matter, the sooner will local government be altogether in their hands.

It would serve no good purpose to give a list of the dates on which municipalities were formed in different localities. It will suffice to remark that while special bills have been passed for the presidential cities, mofussil towns have been provided for by an Act passed in 1863, for the appointment of municipal commissions, and for making better provision for the conservancy, improvement and watching of towns and cities, and for the levying of rates and taxes. With regard to the beneficial results already effected, one instance may suffice. In Mr. Crawford's annual report of the Bombay municipality for the year 1868, the gradual reduction of mortality under energetic sanitation is thus shown :—

1864,	25,015	persons died,	or one in every 32	of the population.
1865,	28,631	do.	do.	28 do.
1866,	16,865	do.	do.	48 do.
1867,	15,500	do.	do.	52 do.
1868,	15,702	do.	do.	52 do.

The system of vaccination has been considerably extended and improved within the decade, particularly in Bengal Proper. Up to the year 1827, the work of vaccination was entrusted to Civil Surgeons. The first grand advance was made in Bombay in that year, when four European superintendents were appointed in that Presidency. It was not, however, until some years afterwards that the example was followed in other provinces. In 1854 superintendents were appointed in the North-West. In 1863 the Panjab Vaccination Department was placed on its present footing. Vaccination under European superintendence was introduced into the Central Provinces in 1864, and into Oudh in 1867. In 1865 vaccination under Civil Surgeons was declared a failure in Madras, and a more sufficient establishment under European superintendents formed. But in some parts of Bengal the old

system still prevails, although the Darjeeling Vaccine Circle was formed in that province in 1866-67, and the Ranchi and smaller Circle of Sonthal Pergunnahs (under a sub-assistant Surgeon) in 1867-68. In the native states of Rajputana and Central India, vaccination is inefficiently carried on by a few vaccinators attached to the dispensaries, the introduction of vaccination in many of the states dating within the last ten years. It should also be mentioned that the three presidency towns are supplied with vaccinators under European superintendence, Calcutta being supervised by Dr. Charles, who has recently recommended a vaccine circle as a 'shield' round that city.

Chiefly in consequence of the exertions of the officer just mentioned, inoculation has been prohibited by law in Calcutta since 1865, and in the villages in the neighbourhood of Calcutta and in several large stations in Bengal since 1866. By a still more recent bill inoculation has also been prohibited in Gurhwal and Kumaon. Practically, however, in the latter hill districts, inoculation had been prevented under the Penal Code for some years previously, but this procedure having at length been found 'not lawful,' an Act of the Supreme Council became necessary. When under consideration, Mr. Strachey remarked that he could state from personal experience, that 15 years ago no part of India suffered more severely from small-pox than Gurhwal. He never heard of epidemics of cholera or plague more fatal. But since the introduction of vaccination, small-pox had almost ceased. The people were protected to an extent almost unsurpassed.

It has been objected, and Dr. Charles, we are sorry to see, has given the weight of his authority to the objection, that unless vaccination can be completely substituted for inoculation, the latter should be permitted as a preservative means better than none at all. We take this opportunity of emphatically protesting against this view of the matter. Nothing tends more to disseminate small-pox than inoculation. And when this operation is performed, no one can positively prophesy the results. The disease thus originated may be mild or the reverse, and in any case becomes a fresh centre of infection. We are fully aware, that it is impossible, without undue expenditure, to make vaccination universal through paid vaccinators. We fully agree with Dr. Pearson, that "all that can be done under "ordinary means, and such as the finances will admit of, is "merely like a shower to the ocean." But inoculation being

altogether prohibited, those pursuing this avocation would *ex necessitate* turn their attention to vaccination, and so numbers would thus be protected by the prophylaxis, who now undergo inoculation. There is a wide difference between the enforcement of any surgical operation, even although one so harmless as vaccination, calculated to prevent disease, and the suppression of a surgical operation, which like inoculation, we know, disseminates a most loathsome malady. The arguments against the former cannot be used in favour of the latter. Neither is the preservative action of inoculation worthy of the slightest attention. Without inoculation, even if vaccination were less practised, the amount of small-pox in the country would be diminished; whereas persons inoculated convey the malady from place to place, and each becomes a fresh centre of infection.

In addition to the actual mortality caused by small-pox, the after results on the eyes, limbs, skin and constitution generally, are sufficient to stamp the malady as one of the most fatal now retarding progress in this country. As Macaulay compared plague and small-pox, as they occurred in England in times gone by, so cholera and small-pox may be now compared in India. "The track of the plague had been more rapid, but the plague visited our shores only once or twice within living memory, but the small-pox was always present, filling the churchyard with corpses, leaving on those whose lives it spared the hideous traces of its power, turning the babe into a changeling at which the mother shuddered, and making the eyes and cheeks of the betrothed maiden objects of horror to her lover." Yet, in spite of such ravages, in spite of the fact that small-pox slays more people in India, either directly or indirectly, than perhaps any other three diseases, in spite of the facts that in all countries where vaccination has been systematically carried on—the United Kingdom, France, Sweden, Westphalia, Bohemia—small-pox has become a comparatively harmless and unfrequent visitor, in spite of the declaration of one of the greatest of living authorities, Sir J. V. Simpson, that small-pox might be altogether 'stamped out' by sanitary measures, in spite of the fact that it has been so temporarily stamped out in many localities in this country,—in spite of all this, there is hesitation in preventing inoculation, and a committee of the Bombay Association recently deputed to consider the subject of compulsory vaccination, ignoring the fact that it has been found necessary

in more civilized countries, reported that the expected benefits were not sufficient to justify any such law! The only possible excuse is that the members of the said committee were not well acquainted with either the ravages of small-pox or the powers of vaccination. They cannot, however, be now excused on any such grounds, Dr. Lumsdaine, the Health Officer of Bombay, having addressed a most exhaustive essay on vaccination to the Association.

The system of vaccination now generally adopted in India, is the close inspection by special European superintendents of work done by native subordinates. The establishments of vaccinators are spread over a considerable extent of country, and the European officer follows the vaccinators, verifying by actual inspection the returns they make. Hence, as a general rule, the vaccination is good,—perhaps often better than that performed at so much per head by parish vaccinators in England. Much of the success of vaccination, of its power as a prophylaxis, depends upon the care with which the operation is performed. The idea that any one will do for a vaccinator is altogether erroneous. The better educated the person is, the better vaccinator he will make. In 1864 the Government in a review of vaccine operations, remarked that the reported failure of certain native deputy-superintendents, might be attributed to the fact that they were all sub-assistant Surgeons, “a class of men who would naturally prefer practising the professions to which they had been trained, and who are too highly educated for the less interesting and mechanical duties of superintending vaccine operations.” But all knowing any thing practically about vaccination, must respectfully differ from the above. Both a vaccinator and a superintendent should at least be able to judge regarding the freedom of both children vaccinated, and those from whom lymph is taken, from either *latent* or patent disease. There are maladies only discernible to the educated eye which should forbid vaccine operations at least temporarily. And the operation itself requires a certain amount of manual dexterity only to be acquired by practice. Vaccination is, indeed, an *important* and not a *trivial* operation, and if it always could be performed by qualified medical men, the results would be more satisfactory. It was probably this feeling of the insignificance of the vaccinator's business, which led to Superintendents of vaccination being classed as second class civil appointments, with salary

attached of less value than the medical charge of a native Corps. But a protest forwarded by the Principal Inspector General of Bombay led to an alteration of this financial rule.

Formerly much antipathy to vaccination existed, but this is in many districts in British India fast giving way. The people have become accustomed to the operation, which is now divested of its terrors, and moreover the utility of the procedure has been often directly proved. But in the native states, much antipathy still exists. And this may be accounted for by the small agency employed, an agency totally inadequate to produce any decided and appreciable results. In only one native state in Rajputana, namely Bhurtpur, is there any adequate system of vaccination. In that principality, however, Dr. Harvey, the Superintendent, states that the results of the last epidemic of small-pox in 1869 were diametrically opposed to the epidemic of 1861. During the earlier period the people shunned vaccination, during the later they courted it. The interval having been made use of in spreading the preventive means, the people could appreciate its value. Some idea of the difficulties attending the spread of vaccination in the native states may be gained by the following quotation.* “The population of Marwar firmly believe Variola to be under the control of the goddess *Mata*, in whose honour temples abound, and fairs are even held. Near Joudpoor, is a space of ground filled with trees, and called *Kagli ka Bagh*, and containing the *Setla Devi* temple. In the month of March a *Mela* (fair) is here held in honour of *Mata*, and thousands of women and children attend with offerings for the goddess. The declivities of most of the numerous conical hills present either a reddened stone, or temple devoted to *Mata*, with most probably an attendant Brahmin priest. Nearly every village has its goddess of small-pox in the immediate locality, and in many places a large piece of ground is esteemed holy and called *Mata ka Than*. The people do not pray to escape the affection, unless in seasons when it occurs with more than ordinary violence. They do, however, petition for a mild visitation. But even the loss of an eye does not appear to be viewed as a very serious calamity. Is there not the other eye sufficient for all purposes? questioned a philosopher. If it

* Marwar, the Land of Death; by Dr. Moore. *Indian Annals of Medical Science*, vol. xx.

“were the leg or hand, it would be different, but an eye is immaterial! The pitting produced by small-pox is by some considered rather an addition to beauty than otherwise, as black patches on the face were among English belles of former days. Moreover others imagine an attack of small-pox not proving fatal demonstrates the favour of the goddess on the fortunate individual. As will be supposed among such a people, the establishment of vaccination is no easy matter.”

In order to spread information regarding the prophylaxis, a vernacular history of its origin and progress has been extensively circulated throughout Rajputana, both in Persian and Hindi. In the Bombay Presidency a pamphlet on the same subject by Dr. Plumtree has been printed in Guzeratti. Dr. Shortt also followed a similar course in Madras. In 1863 Superintendents were requested by the Principal Inspector General at Bombay to make known, with a view to publication in the vernacular, any facts demonstrating the protective power of vaccination.

Dr. Shortt also contributed some valuable information regarding vaccination from the heifer, giving an interesting account of the experiments. Vaccination from the cow was also tried by Dr. Pearson, and by Dr. Burr at Jeypoor. At the present time, the subject has been taken up by Dr. Blanc in England.

The subject of the preservation of vaccine lymph has also received considerable attention. During the last ten years, the use of the glass capillary tubes has become very general. Dr. Charles recommends keeping the sealed lymph in porous earthen gharas of water. Dr. Harvey has experimented with lymph diluted with glycerine, but found it did not retain its power during the hot season, although the plan of so diluting fresh lymph, when scarce, and large numbers require vaccinating should be borne in mind. Dr. Harvey has also experimented with crusts kept in glycerine during a hot season, but with no degree of success. Lymph on points enveloped in goldbeater's skin and then sealed in tubes, has also been recommended.

In conclusion we take the opportunity of adding our testimony to the purity and power of the lymph supplied by Dr. Pearson from the Kumaon hill dépôt. It generally succeeds, and without it it would be difficult to carry on vaccination after the hot season in many localities in the Indian plains.

Although, so far as we are aware, *Trichinia* have never yet been detected in India, there is no manner of doubt that the animal food consumed in this country is frequently the seat of other varieties of parasites. And there is every reason to believe, that this is often a cause of disease among the meat-eating inhabitants of the country—especially among Europeans. It is not generally known that cattle and sheep when hungry, are very unclean feeders. During that period of the year in India when the monsoon rain produces abundance of grass, sheep and cattle will from preference feed on their natural means of sustenance. But it is far otherwise at other seasons. No sooner with the cessation of the rains does the country begin to assume the dry appearance of the cold weather, to be followed by the arid bare aspect of the hot months, than the cattle eagerly devour not only grass, but every particle of foreign substance, provided it be soft, which they happen to meet with. And when the habits of the natives are recollected—that in all localities not immediately under European supervision there are no such things as latrines, that the ordure of the population of villages and cities is deposited on the surface of the ground, or in the neighbouring ravines and hollows, the amount of filth presented to the cattle and sheep going to and returning from their pasture may be better imagined than described. And cattle in India are not as in Europe confined in fields at night. They are driven from the village in the morning to graze on the waste lands in the locality, and at night are herded back again to the fold outside the walls, hedges, or other limits of the village. And twice a day they pass over the cloaca of the population! Pigs are not one whit more dirty feeders than Indian cattle and sheep. The former will consume ordure, old clothing, rotting bones, or even putrid flesh, with the greatest avidity. And in making this assertion we simply remark what we have seen a hundred times. During the recent famine year, the cattle being more hungry than usual owing to the failure of grass, we have many times been obliged to witness sights which are too disgusting to be described in these pages. And this occurs every year, though perhaps to a less extent.

Now if it be true, as it most certainly is, that the *ova* of certain parasites are contained in the alvine discharges of those afflicted with the mature form, and that they may pass through their mature development in the bodies of animals, it is easy to imagine the amount of latent disease which must thus be

promulgated. The hydatid cyst derived from the larvæ contained in human ordure, grows in the flesh of the cattle and sheep used for human food, is consumed by the meat-eater, and although the vitality of the great majority is destroyed by cooking, many germinate into the tapeworm so prevalent in this country. And the number of pariah dogs and pigs infesting every Indian village cannot but add to the danger. Kuchenmeister, Leuckart, Humbert, and Cobbold have with certainty traced the origin of some forms of *entozoa* to dogs and pigs, the ordure of which are devoured with equal zest by our supposed grass-eating herbivorous animals! The fact of the Muham-madans—the flesh-eating natives of India—being especially more prone to tapeworm than the Hindus, is conclusive that their troublesome malady is introduced into the system through the medium of butcher's meat.

There are no means of ascertaining with exactness the amount of diseased meat supplied by contractors to European soldiers in India, but for one station at least a return is forthcoming. Dr. Fleming * states that at Mean Meer in 1868, 2,651 cattle were slaughtered for the use of the troops, and of this number 235 were found "cyst" infected, and condemned as unfit for food, the percentage being 8·86. The average price was Rs. 8-8 per head, showing a loss to Government of Rs. 3,944 or £394. And this amount of prevailing cattle disease may probably represent the ratio in many other parts of India, although attention to the subject may not have brought it to light. But a large quantity of butcher's meat is also supplied to others than soldiers, to officers, private families, and natives. It is only reasonable to presume that where Government with a special Commissariat corps fails in supplying healthy meat to the soldier, private purchasers do not fare better. Thus the full account of the injuries silently inflicted on the unlucky flesh consumers of India scarcely appears on the surface.

As Dr. Fleming very truly observes, tapeworms are not pleasant companions, and produce symptoms often of a serious nature. Upwards of a hundred cases are recorded, both in our own country and on the Continent, where the *scolex* condition of the tapeworm has infested the human body, and caused death by epileptic sergines consequent on the development of the hydatid in the brain or other vital organ. The importance of the subject therefore

* *Indian Medical Gazette*, June 1869.

is unquestioned, and a practical lesson should be taken from the condition of the inhabitants of Abyssinnia and Iceland, the former of whom, according to Blanc, are all subjects of tapeworm, the latter, by Dr. Hyfenessn's account, being almost as badly circumstanced—the condition of both doubtless caused by defective conservancy.

The sanitary measures required for the prevention of the spread of *hydatid* or tapeworm disease, may be readily named. A system of latrines should be established in every village, and the inhabitants prevented from depositing their ordure in the direct track of the herds going to and returning from their pasture grounds. An examination should also take place in all cyst-infected districts, with the view of discovering and treating medically all persons infected with tapeworm. Unless these measures are adopted, we may confidently expect a gradual extension of this form of disease in India.

But ignoring the probability of meat in India being cyst-infected, that supplied to the troops and brought into the bazars for general sale, is ordinarily of the most inferior description. In the hot weather especially, the carcase of a sheep would almost serve as the substitute for a glass lantern, would certainly, if deprived of the colouring of the red globules, permit the passage of light with as great facility as the horn lanterns in use a generation back. Neither, unless artificially fed can cattle or sheep in the hot season be otherwise than very thin. Grass, indeed, does not exist in their jungly pastures more than sufficient to maintain their existence. And contractors are not paid for grain-fed butcher's meat. In that part of India of which we have most experience, a sheep fed on grain becomes, before being thought fit for the table or equal to an ordinarily fed English sheep, from eight to ten times more costly. In other words it consumes from eight to ten times its unfed value in grain. It is therefore manifestly impossible that the barracks can be supplied with grain-fed meat, or that the poorer classes of Europeans can indulge in such luxuries.

But it is admitted on all hands that soldiers should be afforded ordinarily good flesh food. Cattle or sheep, fed to the obesity of Christmas prize animals, are certainly not required. But on the other hand, something more nourishing and digestible than the ordinary barrack meat is desirable, especially during the hot season. The old idea that animal food is not essential in tropical climates, is to a certain extent a mistake. To live

as the natives live, was the advice bestowed years ago on persons coming to India. But those who offered this counsel, do not appear to have recollected, that fat in the form of ghee and butter forms at least as large a proportion in the food of even Hindus in India, as animal diet does in the food consumed by the inhabitants of Europe. And practically, experience shows that Europeans in India require a generous and ordinarily tempting diet. Much of the sickness from which Europeans suffer, which has ere now been in general terms attributed to over-eating and drinking, is in fact, in very many individual instances, more connected with the very reverse. People in India, do not, as is or at least was formerly popularly supposed, live on hot curries, spiced dishes and stimulating drinks. The difficulty in India, especially during recent years and more particularly in Western India, is to procure a wholesome and plain diet. The common necessaries of life, such as butcher's meat, fowls, bread, have indeed become so scarce and high priced, that in some stations preserved provisions imported from Europe may be consumed at the same cost! The appetite in a tropical hot season is ordinarily very capricious. Unless fairly good food is presented, it will probably be loathed and remain unconsumed. The strain on the system during the hot and rainy months is severe. Unless a person be properly nourished, he becomes an easy prey to malarious fever. And this having once established itself in the system, paves the way for the whole tribe of tropical ailments, hepatic maladies, dysentery, spleen disease, scurvy, and their various and complicated manifestations. Fairly good food, moreover, by satisfying the appetite, prevents recourse to those deleterious stews, curries, and peppery compounds, which the soldier and others, disgusted by indifferent food and sameness of diet, so frequently indulge in.

Since the mutinies, a larger number of Europeans than formerly have been resident in India. Estimating the Anglo-Indian army to consist in round numbers of some 75,000 men, the number of cattle and sheep annually slaughtered for the consumption of the military alone is necessarily very large. From seventy to eighty of the small cattle of this country, or three times that number of sheep, are required to feed a regiment of 1,000 strong every month. From this large and continuous consumption of flesh food during recent years, from the periodical occurrence of cattle plague, from land formerly pasture having during the American war been converted into cotton fields, and

from an ever increasing dislike of the Hindu population to sell their beasts with the knowledge that the destination is the butcher's shamble, the task of obtaining a sufficient amount of flesh food has been gradually becoming more expensive and difficult. This has led to frequent proposals for, and in some localities to the actual formation of, Government cattle farms. And it is confidently anticipated by those best acquainted with the subject, that the extension of such agencies will be eventually thrust upon Government as the only means whereby an almost prohibitive scarcity of, and expenditure on, flesh food may be avoided.

The objections of the native Hindus to killing kine are well known, and this prejudice extends also to selling kine for the consumption of Europeans. A Hindu will look on with more than the proverbial apathy of the race, while a cow or bullock is dying from disease or starvation, will even treat his bovine possessions with the utmost cruelty and carelessness; but to take the animal's life, especially to kill it for the benefit of the European, is quite a different matter. To prevent this, every endeavour is used by the Brahmans. And the Commissariat officer's emissary, sent into the districts to purchase cattle, often finds his ends defeated by the Brahman, when the Muhammadan or the Jat or other owner of cattle would for the sake of gain pocket his scruples with his money. There are certain localities indeed occupied by European troops where the slaughter of kine is altogether forbidden, and where the European is therefore condemned to a mutton diet, as far as butcher's meat is concerned, the whole year round. Strange to say, Mount Aboo, the principal Sanitarium of Western India, is one of the stations where fresh beef is a tabooed article. A certain class of the people—the professional religious orders of the community—object as Hindus to the slaughter of kine. And the interests of the British Government, which should be to render the Hill Sanitaria of India in every manner conducive to health, have been lost sight of in the meritorious desire not to offend the prejudices of the Brahmans and Jains. But the same arguments might apply to other matters, and if so, the progress of India would be altogether stayed. It might indeed apply to our presence at all at Aboo, or indeed in India. For the prejudices of a very large number of natives are still shocked by the sight of the European ruler.

But as the political officers concerned have not been able to obtain permission for the slaughter of kine (and indeed it may be doubted if the endeavour has ever been earnestly made), Government, in order to supplement the diet of the European soldiers sent to the sanitarium, some years since established a piggery on the hill. This, however, as swine must in this country be particularly well fed, is a very expensive arrangement. And, as far as we are aware, it is the only locality in India where pork is supplied to Europeans as an article of rations.

The necessity of salt as an article of daily consumption, and the importance of rendering it as cheap as possible, has long been acknowledged, although perhaps everything which could be done towards the latter desideratum has not yet been accomplished. For instance, while salt is even now brought from Cheshire and France to Calcutta, there is almost any amount of the commodity simply awaiting conveyance from the salt districts of Rajputana. But in order to force the sale of British manufactured salt, an almost prohibitory duty has been placed on salt imported from the native states. The salt customs' line, marked by a great hedge, sometimes living, sometimes dead, and guarded by the customs' preventive service runs from one side of India almost to the other, and while preventing the importation of Rajputana salt into British Provinces, maintains the price of salt made in British territories or brought from England or France to the Calcutta market. Similarly, the passage of Rajputana salt south towards Bombay is equally guarded with zealous care, lest it should interfere with the sale of sea-coast salt, or the article manufactured at Patree in Bombay. Notwithstanding this exclusive policy, it is stated, however, that the price of salt throughout British India is not prohibitory, that the people can obtain as much and that as cheaply as they require. But we cannot believe this to be the case, while salt brought from the other side of the world sells as cheaply as that manufactured within 150 miles of Agra, or while salt costing at Sambhur in Marwar six annas is worth as many rupees in Agra. Even if the people themselves throughout the N. W. P., or indeed in British India generally, do not suffer from the want of cheap salt, there is reason to believe the cattle do, and that thus indirectly the inhabitants of the land

suffer from the maintenance of the present policy. The value of salt in the internal economy of animals is at least as important as in the system of human beings. Cattle in their wild state always frequent, particularly at certain constitutional periods, localities where salt is easily obtainable. Oxen, horses, cows, sheep, all require salt to enable them to thrive. But the present selling price of salt in the N. W. P. and other districts, certainly does not permit that *ad libitum* use of the article so desirable. And there is no doubt that the rates at which salt is sold for human consumption, would bear reduction. In the meantime not one-tenth of the salt available in India is ever brought into the market. The great Sambhur salt lake alone presents acres of crystallized salt, which if it were collected would yield hundreds of tons, but which year after year is washed away by the periodical rains. In other parts of Marwar also large salt fields exist—all now practically useless for the supply of British India.

It is, however, now understood that the Government have succeeded in leasing the salt lakes of Rajputana from the native states of Marwar and Jeypur. This will eventually open up the principal salts of India to general consumption, and render the country altogether independent of imported salt. And although during the present financial crisis we cannot look for much reduction of the duty, there is no doubt that eventually this desideratum will be achieved.

In 1863 the use of salt as a prophylactic against cholera was revived in India by Dr. Beaman, whose father years previously advocated a similar theory. Ten or fifteen grains of salt are to be taken twice or thrice daily, independently of the amount consumed with the meals. Dr. Beaman attributed the freedom from cholera of the prisoners in the Hoshungabad Jail to the prophylactic use of salt, and the papers on the subject were forwarded to Government through Colonel Meade and published in the *Calcutta Gazette*.* Unfortunately, however, we cannot place more faith in the powers of salt taken into the system as a preventive of cholera, than in the assertions which have sometimes been made regarding the freedom of localities from cholera or malarious fever, where the ground is encrusted with saline material. Mooltan, long free from cholera, was at one time said to owe its exemption to this cause, and the same

* Vide Supplement to the *Calcutta Gazette*, May 20, 1863.

has been stated of other places. But eventually, as at Mooltan, cholera has appeared to confound the theories formed.

Very little attention had been paid to the supply of drinking water previous to the report of the Royal Sanitary Commission published in 1863. In that volume may be seen Miss Nightingale's sketch of the Bhisti and Mussack, entitled 'the beginning and end of the water pipe,'—a method of supply which obtains as extensively now as it did then. "Words," says the authoress, "cannot convey the actual state of things." The absence of pumps is much commented upon, and the adoption of some civilized method of supplying barracks, garrisons and towns with water is urged. The Sanitary Commissioners reported the unsatisfactory condition of the water-supply to be one of the cardinal defects of Indian stations, and having obtained numerous reports on the subject, and after *viva voce* examination of many familiar with Indian life, they state, "there can be no doubt, that the water supply "in most of our stations is extremely unsatisfactory, and that "it is often contaminated by organic matter to a most "dangerous extent." Analysis of all water is therefore recommended; and the Indian Cholera Commission arrived at very much the same conclusions.

The condition of the water in the towns and villages of the mofussil has been referred to in our remarks on epidemic fever, where certain simple measures proposed for purification are also noted.

In 1864-65 certain medical officers were permitted to receive instructions with regard to the chemical analysis of water from the Chemical Analysers to Government at the Presidency Towns. And by this agency a trustworthy examination of the water at most of the principal military stations was obtained.

In 1866 the opinions of various authorities were obtained regarding the propriety or otherwise of permitting vegetation to exist in water. The conclusions generally expressed were to the effect that a certain amount of both animal and vegetable life in standing water is desirable, to maintain it in a good condition.

In 1867 a Government circular called for reports as to the best method of filtering water for barracks, &c. And here we venture to quote a proposal then made. "I have long been "of opinion, that most water supplied to barracks should first

“ be filtered, then boiled, and lastly passed through another
“ apparatus. By the first step organic matter is removed, by
“ the second matter in solution is precipitated, by the third
“ the sparkling property is restored by the re-admission of air
“ into the fluid expelled by the boiling. This might easily
“ be brought into practice by the use of three iron tanks of a
“ size sufficient to contain drinking water for the use of those
“ inhabiting each building or block—the first and third tank
“ to be furnished with filtering material, the middle to be used
“ as a boiler,”

In 1869 rules for determining the presence of organic matter in water, framed by Dr. Macnamara, were published by authority. In a preface to these rules, Dr. Macnamara remarks that the means for determining the presence of organic matter are very definite and simple, and so well known that an Assistant Surgeon fresh from Netley is as competent to lay them down as the most experienced chemist. The methods of determining the condition of water mentioned are—taste, smell, appearance, microscopical appearance, the gold test, the permanganate test, and the more tedious process of evaporation and combustion of residue.

The Army Sanitary Commission at home recently recommended that wells in India should be avoided, or at least that water therefrom not used for drinking purposes, unless at a distance from dwellings and carefully covered and protected from subsoil filtration. The Commission justly remark that without pure water, millions may be spent on barracks comparatively in vain. Rivers, streams and lakes are indicated as the better sources of supply. But at very many Indian stations there are neither lakes nor rivers, so that the population is *ex necessitate* entirely dependent on the wells. We have already spoken of the dirty habits of the natives with regard to the village tanks, from which so many draw their supply. Neither is much better care taken of the wells. People wash themselves and their clothing at the brink, and are not at all particular whether the water so used escapes on the surrounding surface, or again descends the shaft. A native would not hesitate to wash his cooking utensils, or his clothes stained by cholera discharges, at the mouth of the well from which he draws his water; and indeed, as we can state from our own knowledge, he would feel much aggrieved, if prevented from doing so. Yet all the water we drink

in India, the soda-water, the tea, the coffee, the 'brandy-pani,' the Indian-brewed beer, is liable to contamination from such a cause.

The Sanitary Commissioner for the Panjab, after mentioning the "fecal matter, the old bones, the empty sardine boxes" and preserved-soup tins," through which Simla water trickles, proposes the storing of rain-water for the supply of that station. And it is stated that rain-water may be kept fit for drinking in common bottles uncorked during the whole hot weather. Where the rainfall is sufficient, it may be advisable thus to substitute for well-water. But in many districts, particularly of Western India, the rainfall is not sufficient to fill cisterns without collecting the water from a large surrounding area, a necessity obviously leading to the mixture of impurities. The common pump, not yet introduced into India, would effectually prevent the contamination so common from the prevailing practice of drawing the water from the open wells. And until pumps are ordinarily used, we fear, boiling and filtering are the only certain, although troublesome, means by which we can secure wholesome drinking water.

The foregoing sketch, although confessedly imperfect, is still at least sufficient to demonstrate that sanitation has become the earnest desire of Government. A reference to almost any of the subjects named will show the minute care and attention which has been paid to the matters in question. Neither has Government hesitated to spend the public money, in whatever direction the desirability of expenditure has been proved. And this we regard as the crucial test of earnestness in the work. In former days, within the memory of the present generation of Indian officials, any such remarks would have been altogether inapplicable. At a time when the authorities did not even attempt to sanitize for their own European soldiers, any attempt to do so for the country generally could scarcely have been looked for. And in fact the records of the period referred to are totally destitute of any reference to sanitary science. With regard to the military, the feelings expressed by an officer of distinction (now in the sere and yellow leaf of age, and *otium cum dignitate* of Bayswater retirement) prevailed that "so long as the men were on parade, they might go to the d—l during the intervals." Of endeavours to amuse, instruct, occupy, or even to house and feed the soldiers properly, there were

literally none. Now, many think the men are almost too tenderly cared for. A certain General was reviewing the troops at a mofussil station, when the medical officer suggested the desirability of upper-storied barracks, as a means whereby the prevalent fevers might be rendered less frequent and fatal. "Upper storied barracks"! exclaimed the chief, totally ignorant of the laws relating to malaria, "never heard of such a thing, and don't see the good they would do!" And, any suggestion regarding the sanitary condition of the country at large was treated with equal derision and contempt. Even at the present time, it not unfrequently happens that the best intentions of Government are frustrated by the obstinacy or ignorance of local officials. As a rule, however, such is not the case. There is generally an earnest desire to carry out the sanitary objects of Government. But at present, we can but be said to be commencing a gigantic task. As Grant Duff recently remarked, "We are fighting against space, and the word *we* denotes a mere fraction of active-minded persons, official and non-official, amongst millions upon millions dull with the torpor of ages." But there is no doubt that we shall succeed.

Found Censorship	1
Private property	7-2
Immigration	9
Immigration	10
Immigration	15
Immigration	16
(P-7) from Public place	17
Immigration into public places	27-28
Immigration	31
Immigration from American ports	37
Immigration from	42
Immigration from	44